Architectural
CONCRETE

California Fruit Growers Exchange

The Architecture—By A. R. Walker, Architect

THE years from 1930 to 1934 represent to the average active architect an all-time low in volume of commercial construction. Especially was this true in Southern California, well-publicized for its over-optimism and rapid expansion. Badly balanced capital structures, highly promotive enterprises, excessive bond obligations coupled with heavy junior mortgages and trust deed financing—all combined to afford weak resistance to the long period of depressed business; and office buildings, along with hotels and apartment houses, were dumped for sale or absorption upon a sick market. Large corporations seeking cheap rental areas were afforded, as never before, opportunities for ownership acquisition at 25 cents or better on the originally invested dollar. Many large oil companies and cash-possessed individuals did so avail themselves, and it became an important and active function of our business to prepare space analyses and comparative investment reports as a basis for purchase or rejection of properties under consideration.

Among several corporate and individual clients who employed our firm for this service, was the California Fruit Growers Exchange, whose problem was to determine a policy of lease renewal, purchase of distressed property, or a new building.

March of 1933 added a new and highly important factor in such programs of analysis in so far as California was concerned. Following the earthquake damage then occurring, a mass of state and city building legislation was enacted to insure greater safety and security in all forms of construction. These new earthquake ordinances, requiring radical change in structural designing methods and in the use and application of finish materials, established a theretofore completely disregarded percentage of depreciation, or write-down, of values to existing structures, and caused corporate groups using trusted moneys to "stop, look and listen" before buying old buildings.

This factor quickly eliminated further consideration by the California Fruit Growers of old building acquisition. Furthermore, the depressed realty market favored purchase of vacant land, and inactive construction favored low commodity and labor prices. In the final analysis, it was proved that instead of having 21 yearly rental receipts for existing premises, the Exchange could, at the end of these same 21 years, have clear title to a valuable piece of land and a building for no greater ultimate cost than the aggregate of current rent. This comparison reveals the wisdom of the owners in deciding to build a new structure—particularly since they now possess a single-purpose building arranged for exact convenience of departments and for efficient conduct of many specialized activities, architecturally reflective of the sturdy industry and struc-

"*Distribution*"—*one of three waste mold panels.*

Entrance lobby. Celotex form liners for walls and ceilings give an unusually soft concrete texture. The painting is on canvas. Frame is concrete, formed with rough side of Celotex.

turally designed to withstand earthquake forces.

The new building fronts south on West Fifth Street at the corner of Hope. Across Fifth Street are the Los Angeles Public Library grounds, assuring a permanent attractive park outlook.

Practical departmental arrangement largely established the plan which, through the lower two stories, substantially covers the 167x98-ft. lot. Three additional floors form a U-shaped plan extending out to Fifth Street, with 10-ft. setbacks on east, north and west fronts, leaving a 45x65-ft. street front court. Two top stories form a rectangular extension of the main body of the building across the rear; and the tower, created upon the center as a simple architectural termination, serves the practical necessities of an elevator penthouse.

Reinforced concrete was determined upon as the system of construction, as embodying a sound and economical structural material complying with stringent engineering design, and an attractive facing and finish for the exterior. The officers and directors of the Exchange insisted on simplicity in design in a structure that reflected enduring qualities—and in that spirit the architects endeavored to express a simple and sturdy building.

The building immediately adjoins a high concrete retaining wall separating upper Hope Street from Fifth Street, necessitating the handling of the building base in harmonious mood, recalling so far as practicable the height and strength of masonry of which it would become a part. Due to the lack of mercantile uses for the first floor and the existence of a large unlighted Board Room on the second floor, a unity of mass was created, affording a harmonious transition.

Fenestration, without painful injury to interior room arrangement, was so controlled as to afford broad wall surfaces and grouped windows. Ornamentation is principally a logical recognition of shaped spandrels, strong concrete grilles and easy flowing terminations to coping walls. The only exterior decorative elements are three waste mold panels, well modeled by Harold Wilson, sculptor, and placed as an integral part of the wall. These three panels represent Production, Distribution and Cooperation, and are handled rather as structural than decorative features. Low, flat-round reliefs tell in allegory the story of each of these foundation functions which brought the organization into being and continue to maintain it.

The concrete forms, for all surfaces other than where plaster waste molds were required, were constructed of plywood in panel sizes. Forming plans were carefully prepared and checked to afford logically spaced panels with joint lines occurring at points coincident with window heads and other governing elements. Tamping was done with infinite care to afford fine, close aggregate at the surface when forms were stripped. Rigid form bracing assured exactness of surface in both directions. Upon completion of stripping, all surfaces were carefully stoned down and washed to disclose uniform color and texture. Waste mold surfaces were tooled to produce greater depth of color. Spandrels were acid stained to complete the feeling of verticality in the long window panels.

The interior of the structure hardly offers material for comment other than the apparently successful experiment of using Celotex board for forming panels and stiles in the entrance lobby and foyer ceilings and walls. These forms were impregnated with a heavy filler of oil and the unusual texture developed a surface, after stripping, which did not require plaster and which has proven most interesting in the final finish. Plywood was used in forming the beam and panel ceilings in the Board Room, which will receive color decoration directly on the concrete.

Over the street front court, which forms a roof garden opening into the third floor by means of French doors, was cast a concrete roof deck with membrane waterproofing and full drainage tile systems. Over this will be provided an earth fill for a stretch of lawn. Walks meander through this garden spot which will be further beautified by boxed trees characterizing the industry.

The Structural Design

By Franklin R. Winch*

REQUIREMENTS of the California Fruit Growers Exchange necessitated the design of a building of the set-back type, with office wings two bays wide, and a longitudinal spacing of the columns to accommodate the parking of two and three cars per bay in the garage which occupies a large part of the ground floor area. The Board Room, located on the second floor and seating 500, is 68 ft. long with a clear span width of 45 ft.

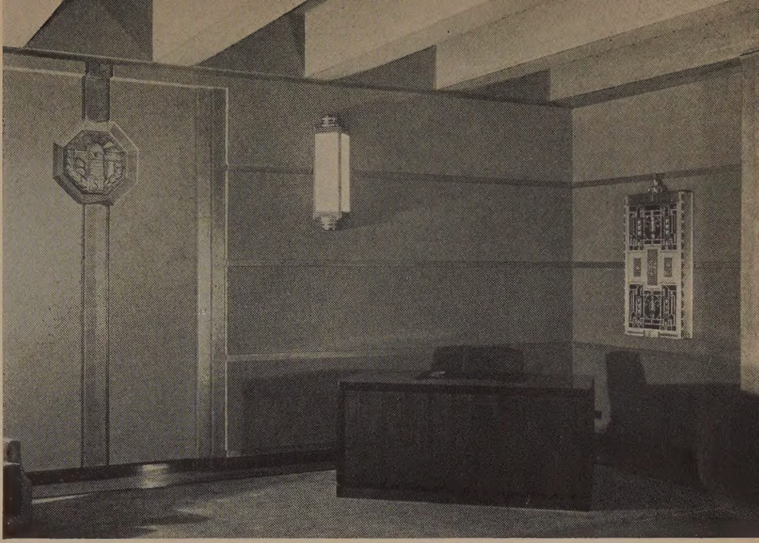
The structure of this building was designed under the direction of the writer in the architect's office. Prof. R. R. Martel of the California Institute of Technology was retained as advisory consultant to the architect.

Various cost estimates revealed that the most economical frame would be one of reinforced concrete using removable steel forms for the floor system and spiral hooped columns with 8-in. filler walls placed monolithically with the concrete spandrels.

This was the first multi-story building for which a permit was issued in Los Angeles, following the incorporation of earthquake lateral force design requirements in the city building ordinance. The same principles involved in the design of smaller buildings to resist earthquake forces were applied to this structure. Structural members were first designed for gravity loading based on allowable working stresses slightly less than the Los Angeles code requirements. Concrete sections and reinforcing steel for the slab and joist floor were designed for stresses just below maximum ordinance requirements. The design stresses assumed for girders, beams and spandrels were about 10 per cent below allowable maximum and the size of the spiral hooped columns was determined by using a column with vertical steel area equivalent to 2 per cent of the core area.

After the structural sections were determined for the gravity loads, the superstructure was then analyzed for horizontal force equal to .08 gravity. Conventional methods were employed for computing the rigidity of all piers, columns and walls, and in locating the center of resistance and mass in each story. The horizontal force to be resisted by the vertical members at each mid-story height was then determined, and the proper reinforcing computed for the combined static and seismic forces. The additional direct load due to the lateral loading was then computed and combined with the gravity loads for foundation design.

ain entrance facade illustrates interesting use of grilles, panels d reveals to relieve an otherwise massive, plain wall.



Foyer walls and ceiling are exposed concrete, formed against Celotex panels. Decoration is applied directly to the concrete.

Foundation design presented the problem of providing a 35-ft. retaining wall on the east and a portion of the north building lines. This retaining wall was of the box frame type, separated from the building superstructure by a 6-in. joint. Footings for the building were carried down to an 8-ft. stratum of blue shale which dipped to the west on an angle of about 20 degrees. Caissons with bell-shaped bottoms were used over the western half of the building, the deepest being 36 ft. below ground floor.

Due to the requirement of the local building ordinance that the structural frame alone be designed to resist a horizontal force of .02 gravity, an analysis of the various bents was made, using the method of distributing fixed end moments developed by Hardy Cross. A meticulous design of the frame in this manner is not believed necessary, since it was revealed that the exterior walls resisted in excess of 95 per cent of the total lateral force and that the absolute maximum which the frame would be called upon to resist would be .05 x .08 = .004 gravity. With this small gravity factor and the 33⅓ per cent increase in the allowable unit stresses, the gravity design in every case in this building was the determining factor.

At the suggestion of Prof. Martel, the entire structure was again analyzed, using a seismic factor of .16 gravity (twice

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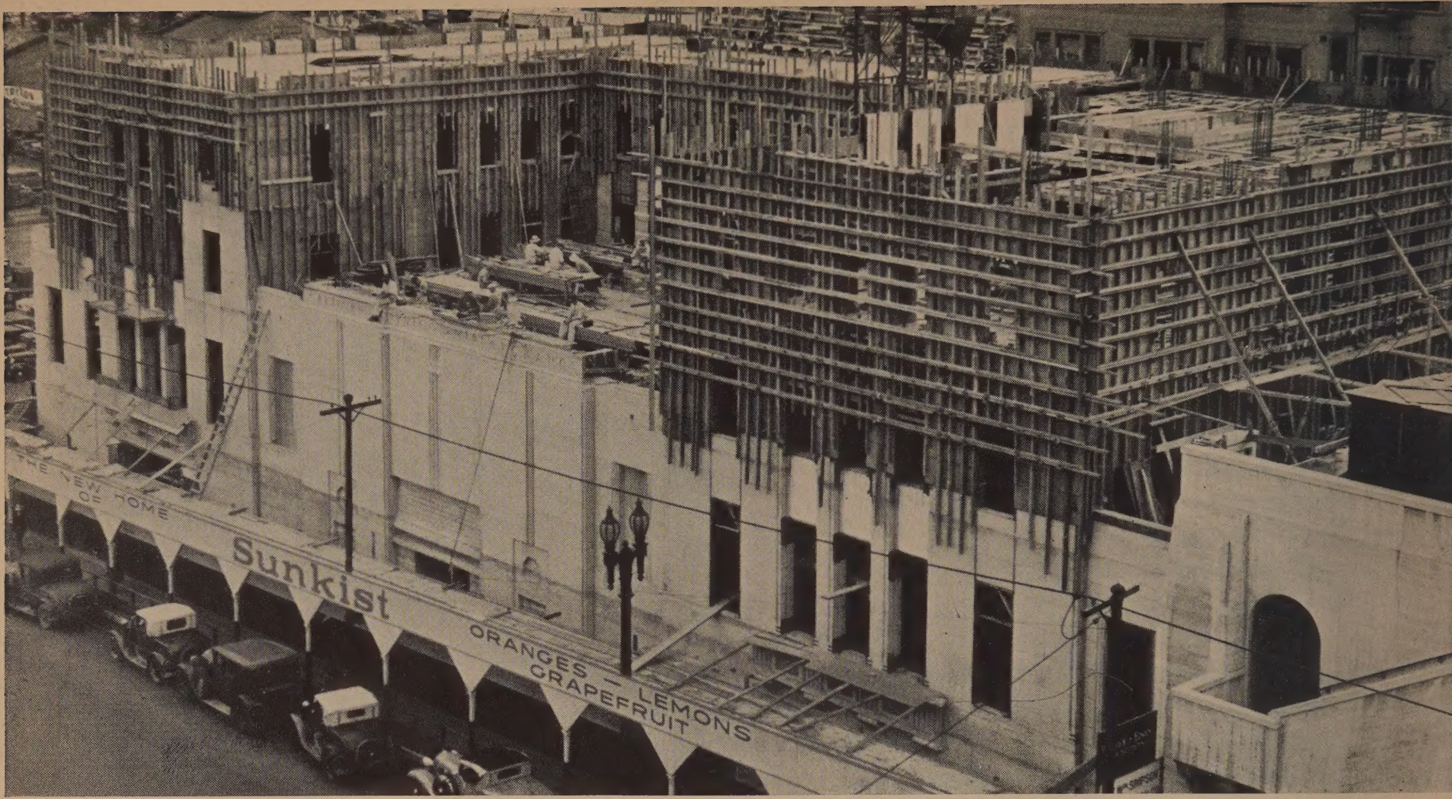
*Chief Engineer, Walker and Eisen, Architects.



The painstaking care exercised by the contractor in constructing forms for this job is clearly shown. One of the first requisites of high quality architectural concrete is good formwork.

the city requirement) and an allowable unit stress increase of 50 per cent and a maximum soil bearing value of 16,000 p.s.f. This design increased the wall and footing steel somewhat, but by such a small percentage of the total steel required that it was thought advisable to adopt this design.

During the erection of the superstructure, it was found that the use of 8-in. filler walls in the lower stories was not as practical as had been anticipated. This was due to the fact that the diagonal steel, required to resist earthquake forces, placed above and below the wall openings restricted the puddling operations and great care had to be exercised to obtain dense concrete at the corners of the openings.

After three or four trial mixes, the following mix for a three-sack batch was used throughout the job: 3 sacks cement, ⅔ cu. ft. fine sand, 9 cu. ft. washed concrete sand, 3 cu. ft. No. 4 pea gravel, and 6 cu. ft. No. 3¾-in. crushed rock. The water-cement ratio used was 6 gal. per sack of cement. The resulting concrete gave very consistent compression tests. The 7-day tests varied between 2175 and 2246 p.s.i. and the 28-day tests ranged from 3251 to 3717.

One interesting field test was made at the request of the City Building Department. An entire bay on the third floor was loaded to twice the design live load—150 p.s.f. Deflection readings were made before, during and after loading. The readings obtained indicated that the floor system deflected 1/5000 of the span with double live load and that no permanent set occurred after removing the load.

Form Construction

By J. C. Edwards*

IN A structure such as the California Fruit Growers Exchange Building in which concrete, as it comes from the forms, is used as the finished surface of the building, the matter of correct form design and construction is imperative, if satisfactory results are to be obtained. The problem is not only that of providing a temporary receptacle for the concrete, but involves also proper design for stripping without damage, executing surface textures, incorporating wood and plaster waste molds, and securing true alignment.

Materials generally used for the finished wall surface are 5-ply Oregon pine panels, ⅝ in. thick, in sizes from 24 to 48 in. wide and from 72 to 144 in. long, sanded two sides and oil treated. Moldings and ornaments are generally made of reverse molds of either wood or plaster. To insure undamaged ornamentation and arrises when using wood reverse molds, deep cut-backs and moldings terminating in an angle of less than 50 deg. should be avoided. Where less than 50 deg. angles are used, most of the damage is done by expansion and contraction of the wood form or reverse mold after the concrete has been placed, and prior to the stripping.

This difficulty can, of course, be avoided by the use of plaster waste molds; but in many instances—such as in long vertical and horizontal runs and panel molds—it is more desirable to use reverse wood molds than plaster, and where no change in finish texture is desired, wood forms or wood reverse molds must be used. While plaster molds permit more detailed and sharper ornamentation than can be obtained with wood, they will not give the same finished texture and should only be used where a change to a smoother and somewhat darker finish is permissible.

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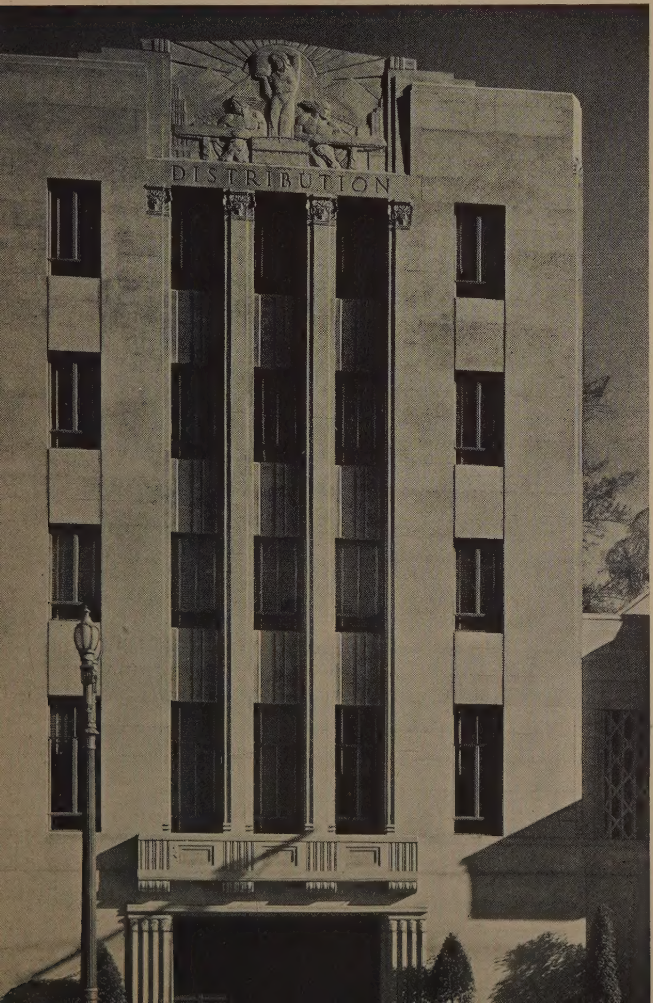
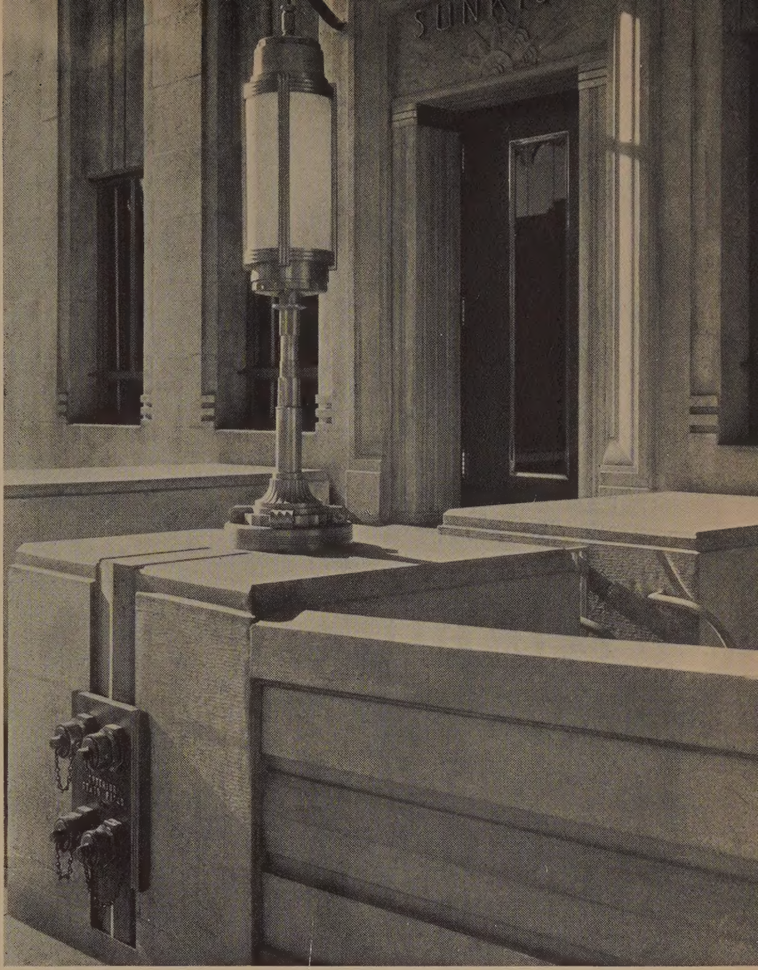
*Wm. Simpson Construction Co.

Rigidity and true alignment can, of course, be assured only through the use of sound construction principles and a decided leaning toward excess bracing, tying and shoring. In multiple-story buildings, a true vertical and horizontal alignment between stories is obtained by extending the exterior form above the construction joint, making it ready to receive the forms above. This section of form at the joint —some 2 ft. wide—should remain unstripped and be carefully pulled tight against the wall after forms below have been removed to take up the shrinkage of the concrete. Otherwise, the concrete from the next run will seep down the shrinkage crack between the form and the hardened concrete making a rough, unsightly line at the joint.

On the Exchange building, ¼-in. pencil rods were used for ties, with set screw buttons at each end. The rods were dipped in hot paraffin to permit their being pulled out easily when forms were stripped.



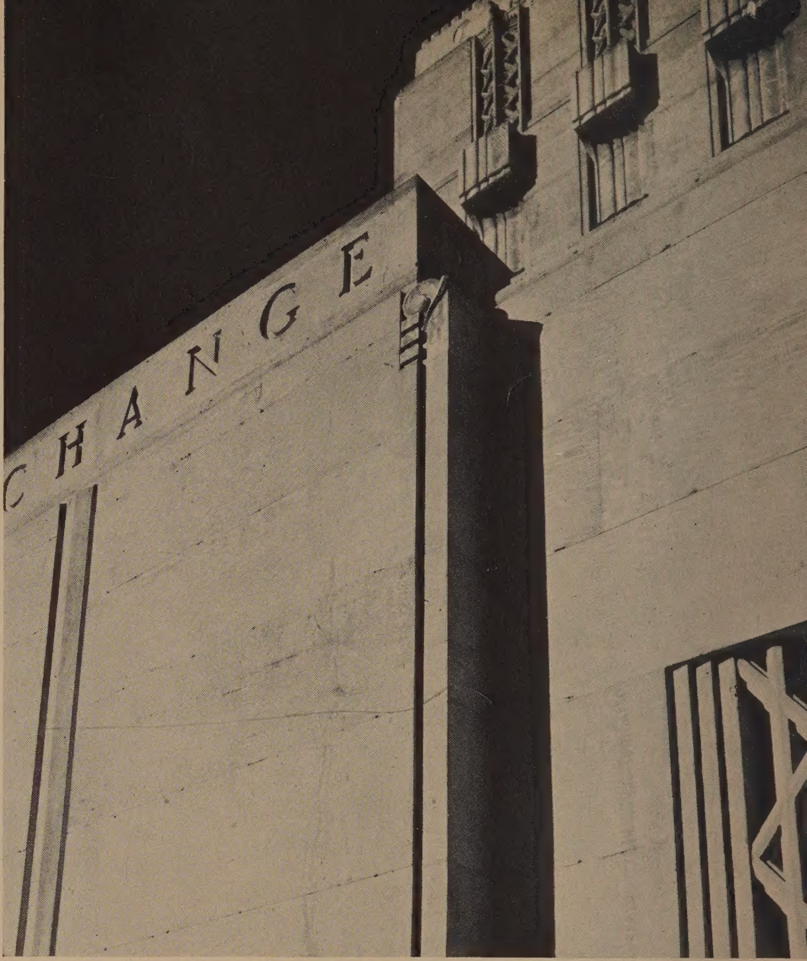
Garage entrance on main facade. All concrete surfaces were rubbed with carborundum bricks and washed after forms were stripped.



Hope Street entrance is a study in interesting masses and textures. Rubberoid roofing form liner produced texture in foreground.

The cost of form building for this type of construction can not be estimated at a unit price per 1,000 board ft. of lumber required; neither can the quantity of lumber be determined by using ordinary units per sq. ft. of contact surface. Due to care and accuracy needed, some forms present labor costs comparable to pattern work for molds for machine castings. For this reason, the work must be performed by skilled mechanics under careful supervision. To expect satisfactory results at the same cost as ordinary structural formwork is absolutely beyond reason.

The successful execution of design by means of carefully formed and placed concrete has opened a new and promising vista in building construction. Architects are fast awakening to the fact that properly handled concrete, placed in properly constructed forms, offers a wide field for them in design at a new low cost for comparable permanence. The greatest contribution they can make to this relatively new method is to place their construction problems in experienced hands and come to a complete understanding of the statement: "Quality remains long after price is forgotten."



The walls of California Fruit Growers Exchange, before finish treatment, show the results of careful, precise formwork and controlled concrete mixtures. In surfaces representing several runs of concrete, there are no visible cold joints.

A Builder Talks About Architectural Concrete

By W. A. Simpson*

IF THE full possibilities of monolithic concrete used as exterior finished walls are to be realized, a careful study of the entire subject of concrete building construction must be made in the light of the experience of those working with the material. It is with the thought of giving to those interested the benefit of the experience of our firm, that this article is written.

An example of the value of experience is found in the construction of the California Fruit Growers Exchange, lately completed in Los Angeles. The responsibility for constructing a home for an international organization such as the producers and distributors of "Sunkist" products, who demanded a structure expressing the high quality that has always been maintained by that organization, requires the application of all the skill, craftsmanship and knowledge in the experience of a builder. Since our experience on this and other buildings in the handling of concrete as a finished surface can be applied to all structures, I have omitted further specific reference to the "Sunkist" building in the balance of this article.

Architects generally, throughout the western part of the United States, recognize the possibilities of architectural concrete and are using it, not only for plain surfaces, but for decorative panels as well. And our firm, recognizing that the use of concrete was gradually becoming more and more important to the building industry, long since decided to direct our efforts toward its development. We have found that the use of concrete as a decorative and finished surface called for a special technique in order to secure desired results. And we found that the use of architectural concrete demands not only study of the material, but particular attention to the general set-up of the organization erecting the forms and placing the concrete in them.

It must be borne in mind that concrete in a building is not mass concrete such as we have in an engineering project. Six and 8-in. walls filled with reinforcing steel, broken up with openings and obstructions of all kinds, are very common. In southern California, where buildings must now be designed for a horizontal earthquake force of 1/10 gravity, the engineering requirements have almost made it impossible to use 8-in. walls with an exposed surface. Reinforcing steel running horizontally and diagonally makes it difficult to place concrete in narrow walls.

As local requirement for compressive strength in buildings is 2,000 lb. in 28 days, only normal care and experience is required to produce a proper "mix" from a strength standpoint. Other important factors, however, make it very necessary to give close attention to the design of the concrete mixture. Sieve analysis, aggregate and slump tests, we find, are not necessary to obtain the desired strength, but vitally important in producing workable concrete. The design of the mixture must be changed from time to time in order to meet unusual or peculiar conditions. Mixes designed by technicians unfamiliar with these practical requirements often may have density and strength, but are absolutely unworkable. The tendency to "play with the mix" sometimes leads to unsatisfactory results as far as the finished surface is concerned.

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*President, William Simpson Construction Co.

Practical experience has taught us that it is not at all difficult to develop a satisfactory concrete for any kind of work on a building. The all-important factors which need to be considered and appear to be more difficult to obtain than good concrete, are as follows:

1—thorough, practical working knowledge of concrete by architectural designers;

2—the desire, on the part of the builder to produce good concrete;

3—to have a complete organization of men who have the ability and knowledge to handle the material properly.

The words "flexibility" and "adaptability" in design have been used rather freely by those writing on architectural concrete construction, but seldom has sufficient stress been placed on the more important factor to be considered, namely: "practicability." Attention to this essential will insure satisfactory results and eliminate the necessity of later covering the surface with an applied coating in order to hide imperfections in concrete or workmanship. It is imperative that the designer confine himself within the limits of "practicability."

Thus, it is necessary that the architect and engineer familiarize themselves with the practical problems developed in construction using architectural concrete. In most building projects, architects have interested themselves in the architectural design and the layout of the building; the engineers have concentrated on the problem of developing structural design to meet architectural requirements and to pass building ordinance requirements. Too little attention has been given to the practical execution of the plans and specifications in so far as they relate to concrete. The use of concrete as finished surface has increased the problems of execution.

The architect and engineer must give serious thought to making it possible to obtain the best results with the fewest chances for imperfections in the finished work. Builders have frequently been confronted with conditions which make it almost impossible to obtain good results.

Cold joints are extremely hard to handle unless they are hidden by some break, mold or recess. Cold joints in panels and spandrels need special thought. A reasonable day's run of concrete should be known by the designer.

The second point—the desire of the builder to produce good concrete—is vitally important, because the policies and intent of the builder determine in advance whether or not the job is to be of the best. We definitely feel that competitive bidding has been a large obstacle in the production of superior construction. In working toward the very best in architectural concrete—as with any other material for that matter—care must be exercised that the builder has a price for his work that will permit him to do a good job. The builder cannot be subjected to cheap competition and expected to give first quality results. Competition among those who have no hesitancy in cutting all items too close, or those with whom "material skinning" has become a habit, is not conducive to good construction. Inspection by a representative of the owner or architect will not in itself secure good results, if the contractor does not intend to do the very best possible work. Proper execution of the job is the problem of the builder and him alone. Instructions to cut the corners close, or a low estimate, generally results in unsatisfactory work.

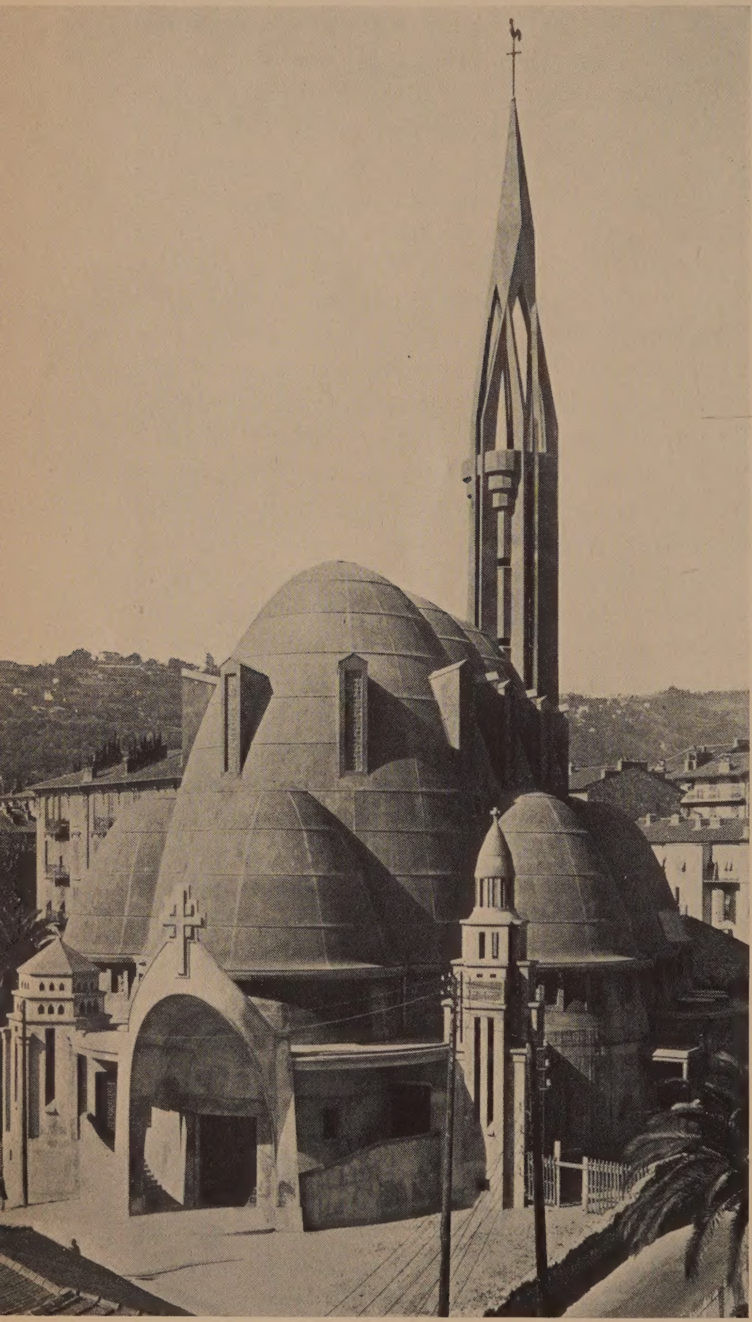
The third point is organization. Care must be taken in the selection of men, if first class results in architectural concrete are expected, the same as in any other type of construction. A superintendent must have had experience, and be a man who takes pride in his work. The foreman must be a fellow who knows concrete and is paid a wage commensurate with the responsibility placed in him. He must be able to think and decide quickly, never permitting a questionable batch of concrete to go into the forms. Such a man is entitled to a good wage. The practice of paying a concrete foreman 50 cents to a dollar a day more than a laborer's wage, in our opinion, does not attract the right man for the position.

Men handling concrete in the forms should be specially selected. A poor man on the end of a vibrator can ruin a day's run of concrete. Careless puddlers can separate the material and produce unsatisfactory concrete. A man who has patched concrete makes a good puddler, because he can visualize the results of poor puddling.

Space will not permit going into all the details of what to do and what not to do. There is no excuse for extremely rough walls, large rock-pockets, hit-and-miss cold joints, up-and-down-hill fill planes, or holes through the wall. Such conditions just do not exist in good work. They should not exist in the work of responsible builders. Good work or bad work does not "just happen." It is produced by men on the job who are working under the instructions of their employers.

Saint Joan of Arc Church—Nice, France

NOTE: *The following has been condensed from a long descriptive article by Ch. Roset, structural and architectural engineer, which appeared in the October, 1935, issue of La Technique des Travaux, Brussels, Belgium.*



Church of Saint Joan of Arc, Nice, France, is a modern architect's solution to two serious problems—unusual space requirements and rigid economy. Jacques Droz, commissioned to design a church over a lozenge-shaped plot, chose a series of 11 concrete ellipsoids to produce this unique but impressive structure. It is entirely concrete, lack of funds making it necessary to forego copper dome sheathing.

LITURGICAL authority, in defining the characteristics of a church only as to the altar, has left architects great liberty in the choice of forms which the church structure may take. Each historical epoch has left us remarkable examples of the individual tendencies of contemporary designers. In more recent periods, however, there has been a paucity of ideas evidenced by the lazy manner in which masterpieces of the past have been copied over and again without original touches. After the war, numerous churches in northern France had to be reconstructed hastily, and since modern artistic trends in architecture have only recently come into being, many opportunities for original work were passed up in that reconstruction program.

Curtailed construction and the scarcity of projects at the present time have surfeited designers with time for thoughtful consideration; and the limitation on funds which marks every architectural commission has made it mandatory that designers seek new and simpler methods of obtaining desired effects of richness and grandeur. Despite the generosity of numerous donators, it is necessary to be most economical of both funds and space in the construction of a modern church. This situation has compelled many French architects engaged in ecclesiastical work to think and work in new forms and modern materials.

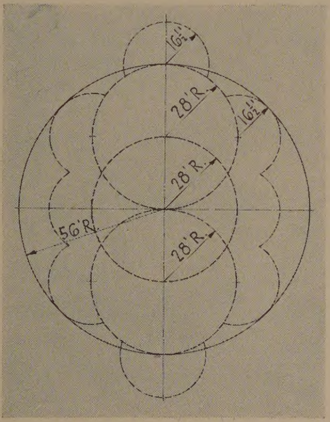
Modern art, while respectful to the ancient, great fundamental principles of construction, is enriched by new ideas and lends itself admirably to economical construction. We can say that, aside from a few rules regarding the form of a church, fancy may follow its own course if it does not lose sight of the great religious principle. It is as necessary as ever to accommodate the maximum number of the faithful with good visibility and best acoustics; the edifice must be dignified and conducive to reverence, and it must reflect the power and permanence of the faith—otherwise there are few limitations.

Already, this new freedom to design has produced interesting results in French church architecture. M. Jacques Droz, designer of several remarkable modern churches, has made notable departures in form to solve the intricate problem presented by the space and requirements for the Saint Joan of Arc Church in Nice.

The plan and, ultimately, the novel form of this church were determined by the peculiar shape of the ground area.

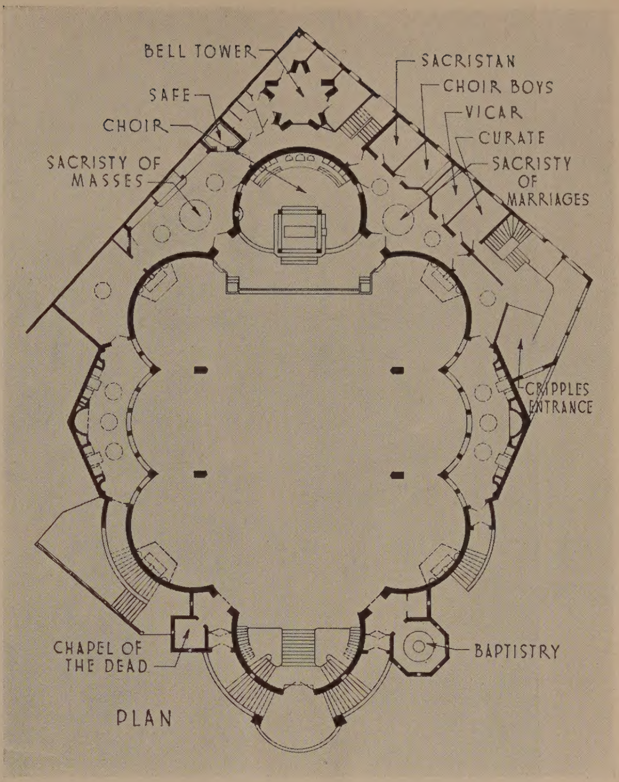
If we examine the plot plan (see diagram), we find that the church reaches practically to the limits of the five points and the four sides of an irregular quadrilateral in which the structure is placed very nearly symmetrically. The principal entrance, placed in an acute angle formed by the intersection of two streets, becomes one pole of an axis of which the isolated tower in the opposite angle is the other extreme. All accessory service rooms and buildings are located in the other angles. The utilization of the ground plot is, therefore, very rational. The major axis of the church, being the diagonal of the plot, is very long. The width of the church is established by a perpendicular to the middle of the major axis reaching to the limits of the lot. With these basic dimensions fixed, it remained to choose an architectural style which would work up naturally from the general form of a lozenge.

In preliminary sketching, there were many possible combinations open to the architect; but, realizing that it is desirable to achieve as great height as possible in a church, he chose a plan of harmonious circles, developing over them a series of three ellipsoidal domes with major axis vertical and six lesser ellipsoids, all their base planes inscribed within a great circle whose center is the intersection of two principal axes of the plan. Two small ellipsoids, placed at each pole of the longitudinal axis on the outer circumference of the great circle, complete the plan (see diagram).



Base planes of three major and six minor ellipsoids were inscribed within a great circle. Two other ellipsoids are centered on the circumference.

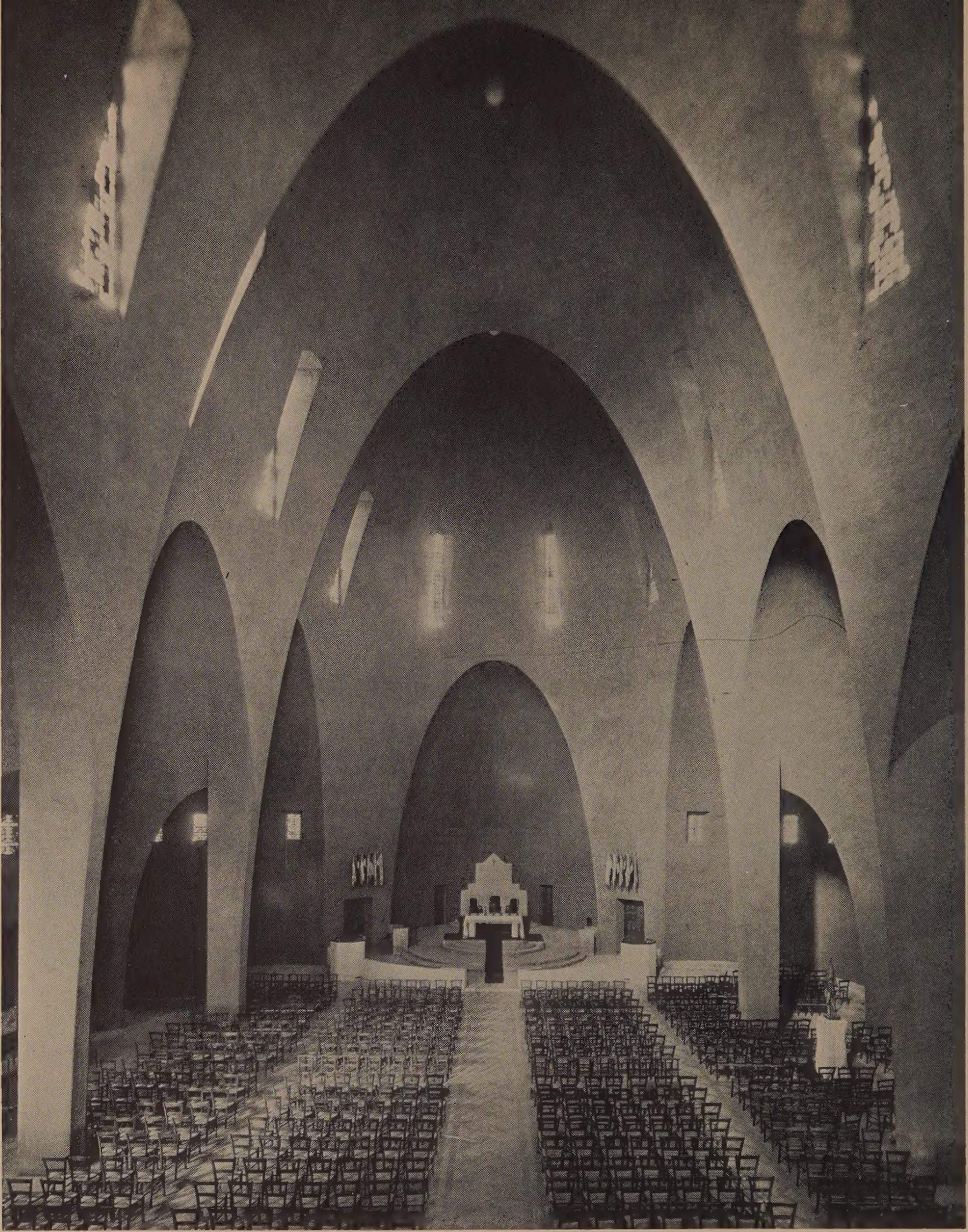
The circular middle planes forming the bases of the three principal ellipsoids have radii of about 28 ft. Two of these ellipsoids are tangent at their bases, and the third has its vertical center axis of revolution at the point of tangency of the other two. The result of the intersection of these three ellipsoids are four tapered columns which follow the curvature of the ellipsoids. These columns carry the load of the large ellipsoids not resting on the enclosure. They also support part of the six smaller ellipsoids, which have base radii of about 16½ ft. The centers of the small domes are points on the base circumferences of the three larger ellipsoids located by diameters perpendicular to the great axis. The height of the large ellipsoids is about 80 ft., that of the lesser ellipsoids, about 47 ft. The structure is 194 ft. long by 141 ft. wide.



Within, the intersection of the many ellipsoids produces a series of large and small elliptical arches. The plan is completed by a monumental entrance in the very characteristic form of a bishop's mitre, and two smaller buildings. At left of the entrance is the baptistry, hexagonal in section and 33 ft. high; at the right is the chapel of the dead, 49 ft. high and of cross-like shape. Finally, clearly separated from the church proper, is the bell tower constructed of ten vertical members placed in a pentagonal star and surmounted by a thin spire consisting of five intersecting pointed arches. The total height of the tower is 197 ft.

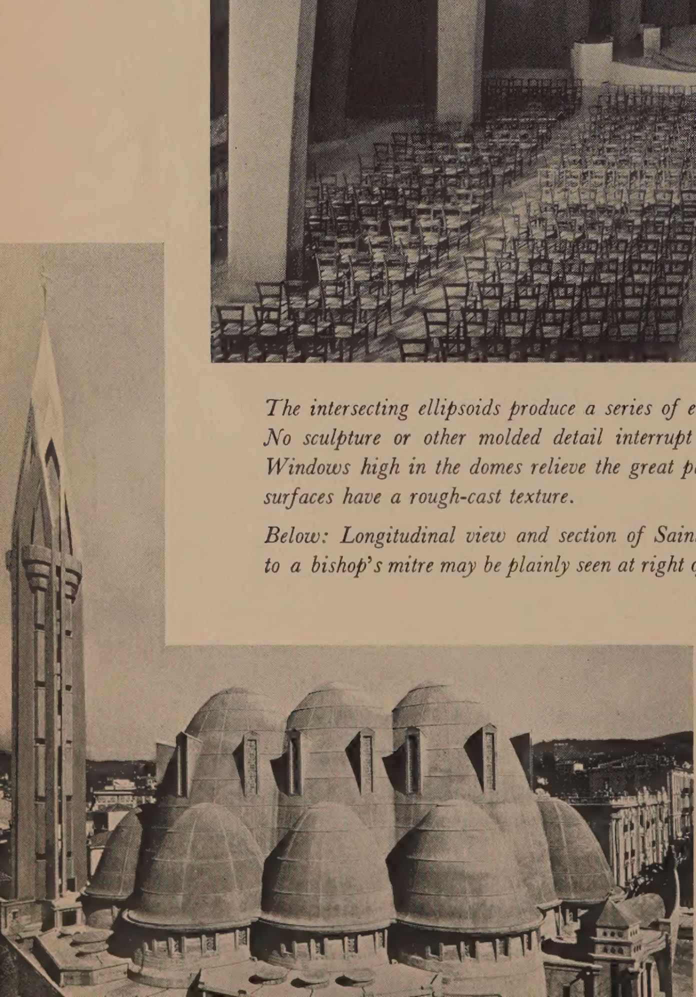
The entire structure is reinforced concrete cast in place. While most of the construction processes were interesting, the most unusual part of the work was the building of the ellipsoidal domes. The concrete in these domes ranges from a thickness of about 3 in. at the crown to 17 in. at the base. The problem was to erect forms and centering for about 21,500 sq. ft. of concrete in varying thicknesses, being careful in the setting of reinforcement over the many curved surfaces of the forms.

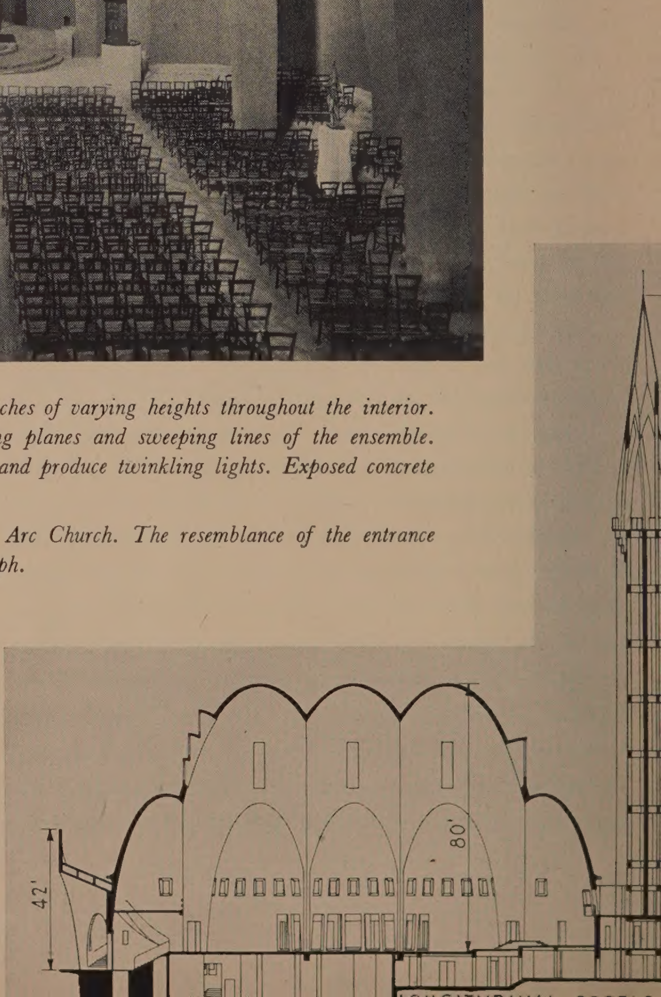
Centering frames or scaffoldings were erected under each of the eleven domes. Form boards were nailed to the frames. Reinforcement was then placed over the forms in two layers, with extra steel as required at the intersections of the domes. A very stiff concrete was tamped and troweled into place. A concrete mixer, capable of a large output, was located



The intersecting ellipsoids produce a series of elliptical arches of varying heights throughout the interior. No sculpture or other molded detail interrupt the curving planes and sweeping lines of the ensemble. Windows high in the domes relieve the great plain areas and produce twinkling lights. Exposed concrete surfaces have a rough-cast texture.

Below: Longitudinal view and section of Saint Joan of Arc Church. The resemblance of the entrance to a bishop's mitre may be plainly seen at right of photograph.



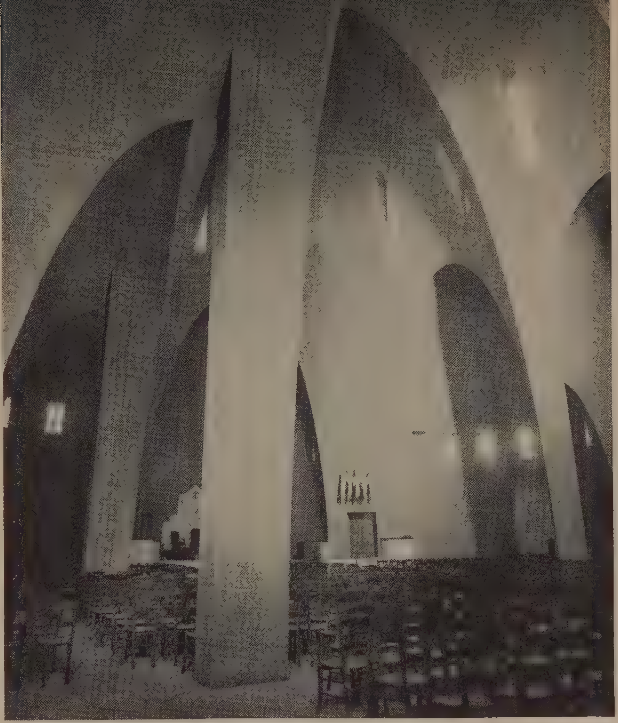


under the domes, the concrete being lifted up to the top of the scaffolding in carts and dumped down on the forms. It was originally intended to cover the domes with a pumice concrete to which sheet copper could be nailed. The cost was found to be prohibitive, so the structural concrete of the domes was left exposed to the weather.

The tower is unique in design and construction. It comprises 10 columns of reinforced concrete placed as the sides of a sharp pentagon inscribed in a circle 20 ft. in diameter. A central stairway at the middle newel permits access by successive landings, spaced 16 ft. apart, to the highest platform, located 128 ft. above ground. From this point, a very sharp rise brings the total height to 197 ft. This open-work spire comprises five pointed arches of reinforced concrete corresponding to the five points of the shaft of the tower. Photographs show the intricacy of the tower, and one can appreciate the necessity for precise formwork in the long point and the intercrossed pointed arches.

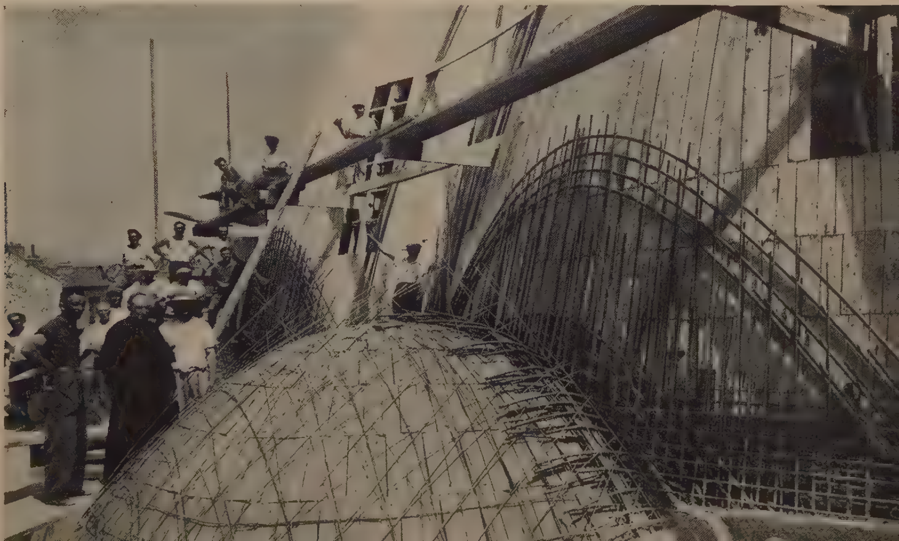
While the exterior of Saint Joan of Arc Church presents as many different aspects as there are angles from which to view it, the interior has a unity of form, color and atmosphere that is the greatest characteristic of this building. It is simple, harmonious, suggestive of religious thought. As one passes through the great portal, a stairway with several steps leads to the floor level of the church, where one is surrounded immediately by a rich atmosphere due to the general tone of the rough-cast concrete. From then on, the eye is drawn to the elegance of the forms and the twinkling of the windows. Three ellipses are imposed on each other, their height apparently increasing (although two are identical), and this perspective effect, emphasized by the four columns, is very beautiful. The lateral arches harmonize with the intersection of the greater groups—all geometrical but artistic forms. No sculpture troubles the unity of this great central section.

The church will hold 2,000 people. For economic reasons, an electric organ will be installed, eliminating the need for cumbersome and unsightly pipes and grilles. Also for economy, chimes located in the lower part of the church transmit to loudspeakers in the tower. Since Nice is situated in a "privileged climate," it was not thought necessary at present to install a heating system. Lighting is provided by lamps under opaline globes in the top of the ellipsoids.

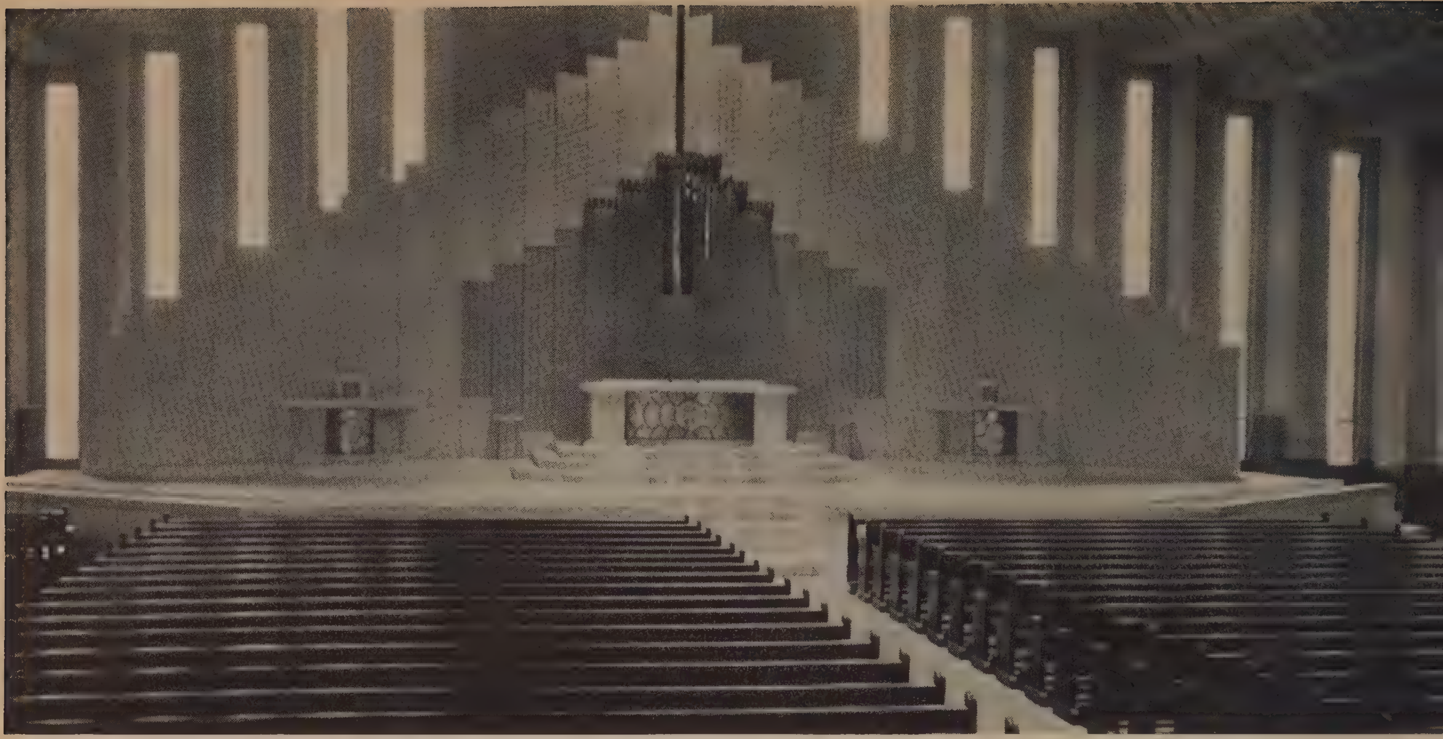


The four columns formed by the intersection of the major ellipsoids also support part of the load of the smaller domes.

Throughout the church there is rarely a straight line. Even the surfaces of the columns have the curvatures of segments of the ellipsoids. Such a design could not well, nor economically, be executed other than in concrete. Finally, as M. Roset says: "It behooves one to remark that this monolithic church is safe from earthquakes; although one does not wish to forecast this calamity so unworthy of the divinity which would otherwise deprive the faithful of a very beautiful and original church."



Forms and reinforcement in place for concreting the domes. Bending the reinforcement into place required great care, since concrete in the domes ranges in thickness from 3 in. at the crown to 17 in. at the sides.



Proximity of altar and pews, and repeated sizes and forms are salient features of the Basic Church. These are exemplified in the concrete Church of Christ the King, Cork, Ireland. Barry Byrne, architect, New York; R. Boyd Barret, associate, Cork.

The Basic Church

By Barry Byrne, Architect

FINANCING and erecting Catholic churches and auxiliary buildings present serious problems in localities where the populations are in a state of flux. In most instances, it has been necessary for a new parish to start from the ground up—services first being held in halls, vacant stores or whatever place offers itself, the pastor housing himself where he can. Meanwhile, the effort is made to erect a plant which, when complete, must include a church, rectory, school and convent. It is evident that any means used to improve the quality of these structures must, of necessity, reduce upkeep and obsolescence, which in the past have been serious and expensive items in church plants more than ten years old. It is also apparent that the burden of debt resulting from the cost of new construction should be reduced to bring carrying charges within the financing ability of the average congregation. This necessitates a more economical form of construction based on modern methods such as have been developed for other types of buildings. Prior to 1929, economy was sometimes an academic question; but today, diminished revenues and the pressing need of church plants make economy a serious consideration. The elimination of fire risk is another factor of serious moment, particularly in rural districts.

The underlying idea for the Basic Church has been to develop a more orderly and economic procedure than has previously existed in church and school construction. The design of the building as illustrated and the type of construction decided upon as most economical are the results of long study and consideration of the many factors involved. It is believed that the design offers a solution of the problem now confronting many Catholic parishes. The cost estimate shows the economy of the construction which has been developed for a dignified, fireproof and durable church.

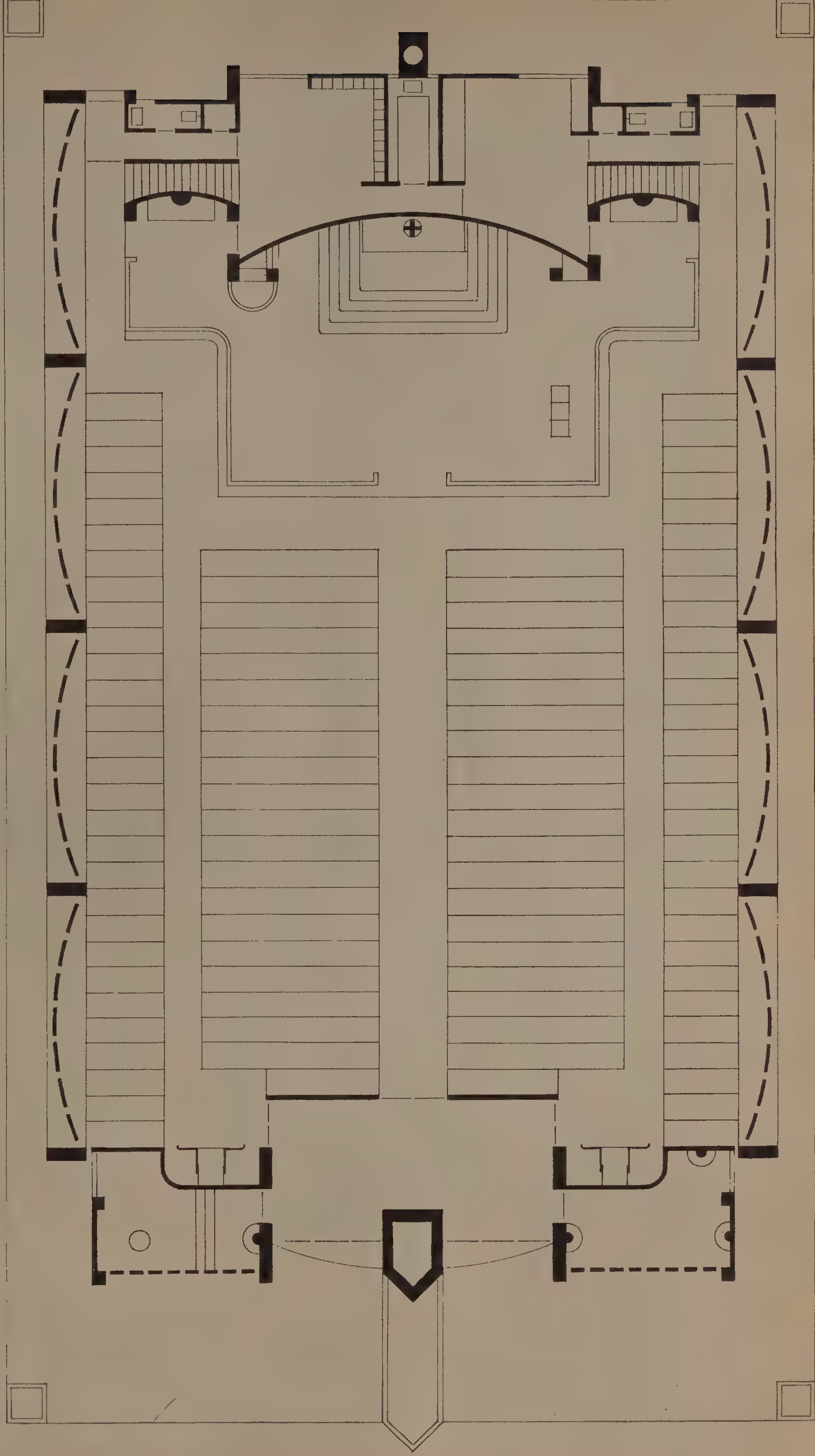
In plan, the Basic Church is similar to plans the author developed for the Pro-cathedral in Tulsa, Okla.; the Church of Christ the King, in Cork, Ireland; and other churches. Fundamentally, the plan was developed to accentuate the relation of the people to the altar. In effect, the end sought is an entire church which approaches the ideal of being, itself, the sanctuary. By the plan used, the people are brought into closer proximity to the altar, more completely identifying their worship and offering with that of the

Seating in this plan is provided for 780 persons.

The choir loft is over the sacristies and is screened by the reredos. It is reached by two stairways behind the side altars. The baptistry, located on the gospel side, is entered from the narthex.

The corresponding space opposite the baptistry is a shrine chapel. This avoids distraction from the Eucharistic purpose of the church proper by too numerous statues.

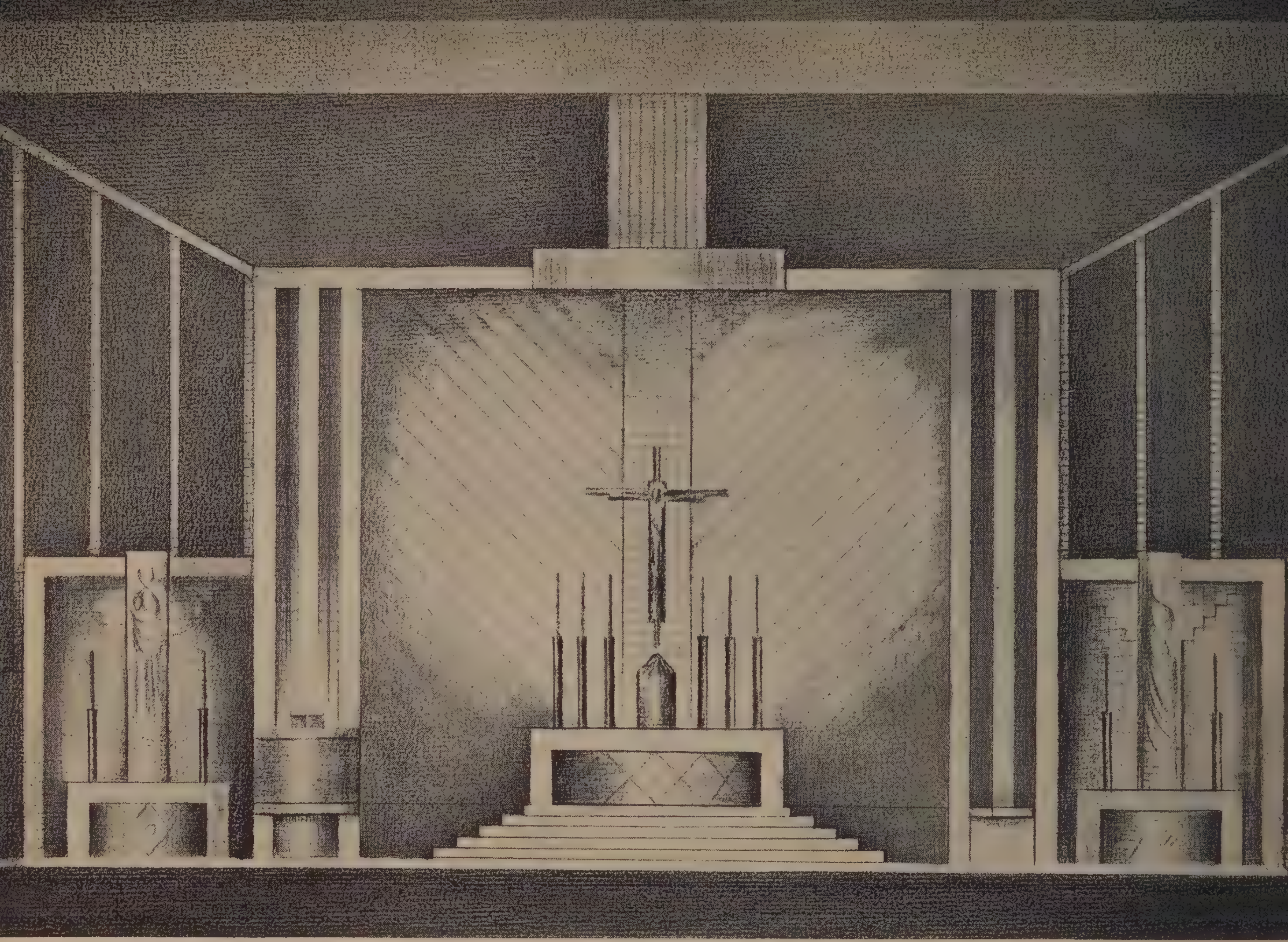
The church is designed to be entirely of concrete finish, inside and out, including the roof.



Barry Byrne
Architect

Maurice Lavanoux
Liturgical Consultant

PLAN OF THE BASIC CHURCH



The architect's impression of the interior of the Basic Church—from a pencil sketch.

officiating clergyman. To further this result, the sanctuary proper projects into the body of the church and the seats are brought up on the sides of it. The contrast of this arrangement with that of churches in the Byzantine, Gothic or Renaissance styles, will be apparent when it is recalled that the altar, in these historic styles, is retired to the rear of the sanctuary and the sanctuary is recessed—like a great alcove—generally projecting from the altar end of the church, and away from the congregation. In correctly developed historic styles, the altar is a remote and distant thing. In the Basic Church, the altar, in contrast, is moved forward into the church and the sanctuary projects into the midst of the worshippers, giving proximity to the altar and a psychological effect of participating in the mysteries of the altar.

Effort was concentrated on producing a monumental, well-constructed, totally fireproof church at an absolute minimum cost. The term, Basic Church, has a definite meaning in this connection, indicating not only a type of building but also a process of construction and finishing elastic enough both to meet present needs and provide for future desires. It is a permanent church that can be built and occupied at a minimum expenditure. The structure would be complete with walls, roof, glazing, lighting and heating, with the exterior brought to a finished surface. The interior design is of pleasing proportions, interesting in its parts, requiring no added finish—but providing for cast stone finish at a later date if desired.

The minimum cost, therefore, results in a usable dignified building suitable for church purposes, to which decoration may be added, if enrichment is desired, without structural alterations, waste of materials, or interruption to use.

Structural elements repeating similar sizes and shapes for the walls and roof of the Basic Church were adopted for economic and architectural reasons. In the Church of Christ the King, at Cork, which is of concrete, use was made of such repeated forms and sizes of elements. This church demonstrated the economy of the method as it was built complete with altars, glass and pews for approximately

$130,000 and has a capacity of 1,400 persons. In the Basic Church, repeated elements of uniform size are the supporting piers, concrete vaulted roof, and prefabricated units of cast stone. The concrete vaults, of which there are four extending across the church, are of the Z-D barrel-shell construction, supported on five piers on each side. The initial structure is, therefore, a skeleton similar in idea to that of office buildings. The wall space between the piers is designed to be filled with prefabricated units of cast stone separated by areas of glass. These cast stone units are factory made and delivered to the building site ready for fitting into the skeleton structure. Polished cast stone or that of the exposed aggregate type such as used in the Department of Justice Building in Washington and the Bahai Temple at Wilmette, Ill., may be used with equally pleasing effects.

The approximate cost of this Basic Church, to seat 780 persons, is $45,000. This estimate is based on building costs in the New York region. If a diocese were to construct a number of churches at one time, as has just been done in the environs of Paris, the cost would be considerably reduced from this already small figure. Exact duplication would not be essential in such group productions, and substantial savings would be effected—even with marked variations in design to suit different sites and seating requirements, and to avoid monotony.

The estimate of $45,000 includes the following items:

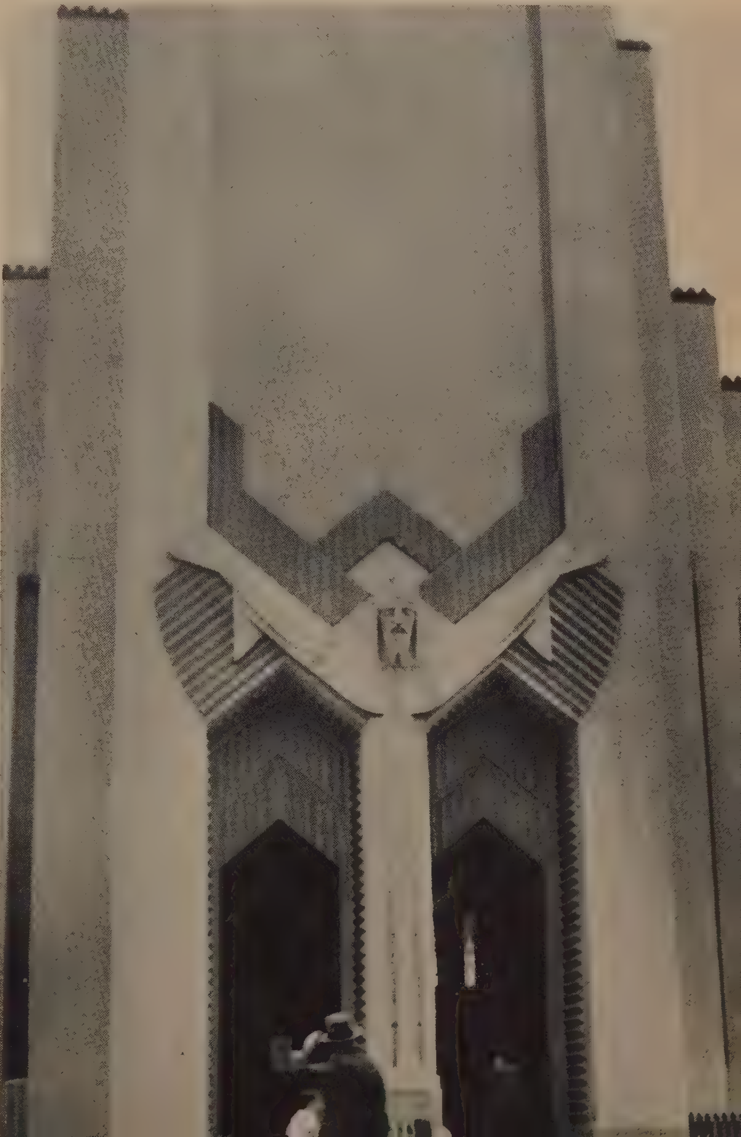
Piers and walls, with foundations and excavation	$10,710
Z-D barrel-shell vaults and supporting beams	9,516
Cast stone for filling between piers in walls	10,968
Concrete floors	2,412
Wall insulation, 1-in. Celotex tile	750
Roof insulation, 1-in. Celotex	650
Roofing, Barrett type	1,180
Steel sash	706
Glass	2,003
Painting	400
Heating	2,430
Wiring	1,200
Plumbing	775
Incidentals	500

In submitting the results of this investigation to the clergy and the architectural profession, the animating idea has been to meet a condition of need within the Church. It has been necessary to design a number of churches around this idea of arrangement and structure, to test its capacity for architectural variation, which is seemingly unlimited. It will be readily seen that a church plan on the basis of such a skeleton structure may take any known form—octagonal, circular, oval or cruciform, or variations and combinations of these forms. The scheme may also be applied to the Gothic aisle-type of plan, the structure permitting the omission of sight-obstructing intermediate piers, since only the piers at the beginning and the end of the aisle are necessary. Any of these variations in plan will produce an entirely different architectural composition in a building designed in harmony with it. There is, therefore, nothing about the Basic Church idea that forces religious edifices into a set mold or size. The reverse is true, as the possibilities in design are elastic.

Any suggestion of impermanence is eliminated in the Basic Church, because it is designed as a church of concrete, with color decoration an integral part of the concrete material and equally imperishable. The intrinsic dignity of an interior of concrete walls and roof, either as they come from the forms or covered with precast decorative concrete, can be appreciated when one recalls the impressive effect of the stone interiors of the older churches in Europe, where the exposed masonry creates an atmosphere which is suitable to that repose of mind which permits absorption in prayerful worship.

The author is indebted to the firm of Roberts and Schaefer Co., engineers and contractors, Chicago, and to John J. Earley, architectural sculptor, Washington, D. C., for engineering and other data in the development of the Basic Church.

Church of Christ the King, Cork, demonstrated that repetition of detail in concrete was effective as well as economical in cost.



Architectural CONCRETE

ARCHITECT · ENGINEER · CONTRACTOR

IN THIS ISSUE

A symposium on the design and construction of California Fruit Growers Exchange finds A. R. Walker describing (page 3) the background and architecture; F. R. Winch, the structural design (page 5); and J. C. Edwards, the construction (page 6). . . . W. A. Simpson gives a 3-point lesson (page 8) on what architects and contractors should know about concrete. . . . The bishop's mitre leads to 11 domes (page 10) and a new form for architecture. . . . The whole Church is the Sanctuary in Barry Byrne's plan (page 14) for the Basic Church. . . . You are now on page 18. . . . The A. I. A. File (pages 19 to 22) goes in for Concrete Grilles. . . . A monolith memorializes (page 23) the Mexican Revolution and does great credit to Enrique Aragon Echeagaray. . . . File 10-7-1 discloses (page 27) four new monoliths under construction. . . . The strange case (page 28) of a Relic full of relics. . . . Knox F. Burnett tells (page 32) of the quest for Power in the North Platte Valley. . . . The subject of markets is reintroduced (page 34) by a review of Portland Public Market. . . . A cheer for the Bronx is recorded (page 36) by George E. Horr.

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Freedom of Design

ARCHITECTS, in reporting their experiences in the use of concrete, almost invariably point to "freedom of design" as a major advantage of the material. But what is this freedom?

Since the advent of architectural concrete, this "freedom" has meant various things: at first, the ability to imitate and reproduce old forms and styles, even to successful simulation of the characteristics of traditional building materials; later, it meant the ability to modify old forms in more practical and economical construction. Now, with the evolution of a new architecture, it is recognized as an opportunity to develop new forms incapable of execution in less flexible materials.

While the adaptability and economy of concrete have wide application in current construction, the greater significance of concrete's design freedom lies in the development of new architectural shapes and forms. There will always be a place for traditional and historical styles in the modern scene, but architecture will not stand still. It has never stood still very long, and it has always been given a sharp stimulus with the introduction of a new material. Stone, and then steel, raised low, squat villages to magnificent and then towering cities. Now there will be other changes.

In this issue of Architectural Concrete, many shadows portend coming events. The strange effects that Dr. Mercer obtained in his museum are a symbol of future possibilities of concrete. With no formal knowledge of architecture or construction, he had no formal inhibitions. Dr. Mercer was accustomed to forming anything he pleased in clay pottery, and he merely transferred his art to reinforced concrete, because it was stronger and adaptable to structural requirements. He believed that concrete would be structurally sound in any shape or form he chose to make it; time proved he was right.

It is not a long step from Dr. Mercer to Architect Droz who, with bold precision, designed a series of eleven intersecting ellipsoids of revolution in a structure that could not be practically nor economically executed in other than concrete. The Saint Joan of Arc Church is certainly a new form inside and out; but it represents only a single departure in the development of novel forms that will one day mark the modern scene.

CONCRETE GRILLES

CONCRETE grilles offer decorative possibilities in architectural concrete buildings. Several methods of construction may be used and the design may be simple or elaborate, depending on architectural requirements. As in all other parts of a building, due consideration must of course be given to the nature of the material from which the grille is made and the manner in which it is built into the wall.

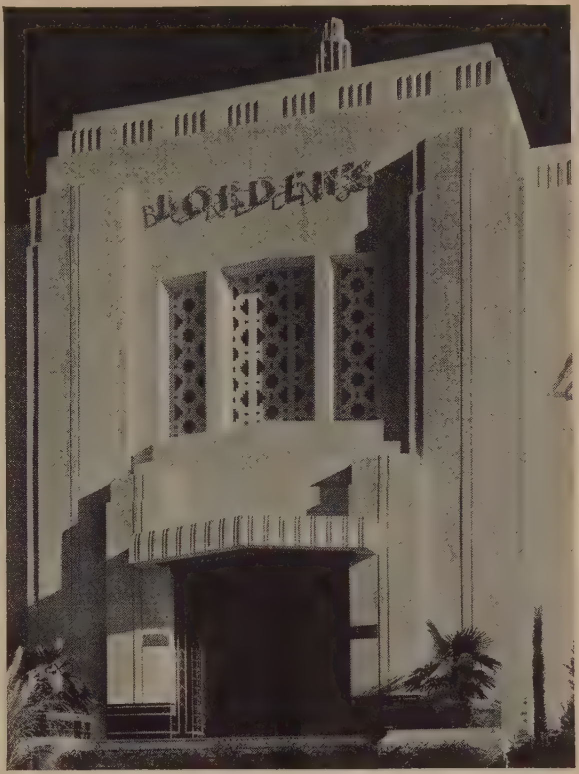
Grilles are of two types—precast and cast-in-place. Those of intricate design, especially if curved members or members having numerous odd intersections and angles are involved, should be precast. By so doing, a relatively shallow mold or form can be laid face down on a platform and the concrete placed in it easily from the back side. Grilles having rectangular or other simply-shaped openings in a fairly regular pattern, separated by members large enough to permit working the concrete into the angles and corners, may be cast in place with the rest of the wall.

When designing grilles, it should be remembered that each member must be reinforced and there may be places where two or three bars will cross. Ample protection for the steel is essential, to prevent corrosion. Precast grilles are subject to considerable stress in handling, making it necessary to have members of substantial proportions. The members of cast-in-place grilles must be of such size that the concrete can be worked into place without leaving void spots. For these reasons, no member should be less than 3 in. square in precast grilles and 4 to 6 in. square in those cast in place.

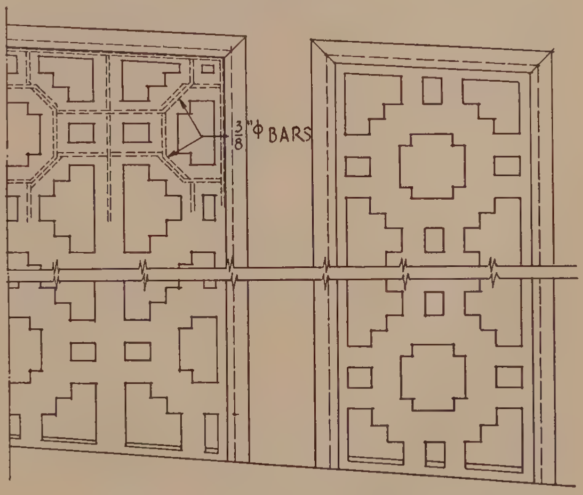
A particularly dense impervious concrete should be used, because the relatively small members are exposed on all sides and there is a maximum number of corners to be attacked by the elements. A low water ratio concrete is, therefore, essential. Preferably, the mixing water should be limited to 6 gal. or less for each sack of cement. The maximum amount of coarse aggregate should be incorporated into the mix, consistent with good workability. It is desirable to use mechanical vibrators as an aid in placing the concrete, particularly in the cast-in-place grille, because high frequency vibration makes the concrete flow into inaccessible corners and a lower water ratio mix can be used then with unaided hand placing.

If the design of a cast-in-place grille is such that the concrete must flow into lateral members more than 6 in. from a point where the concrete is deposited and can be rodded from above, openings should be left in the forms through which the concrete can be observed and assisted into place. The openings should be in the top form of the lateral members but at the back side, so any irregularities caused by replacing the sheathing over the openings will not be noticeable.

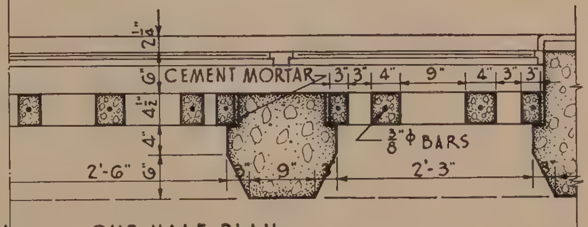
Precast grilles may be set after the concrete in the wall



BORDEN MILK COMPANY, SAN ANTONIO, TEXAS; ATLEE B. AND ROBERT M. AYRES, ARCHITECTS.

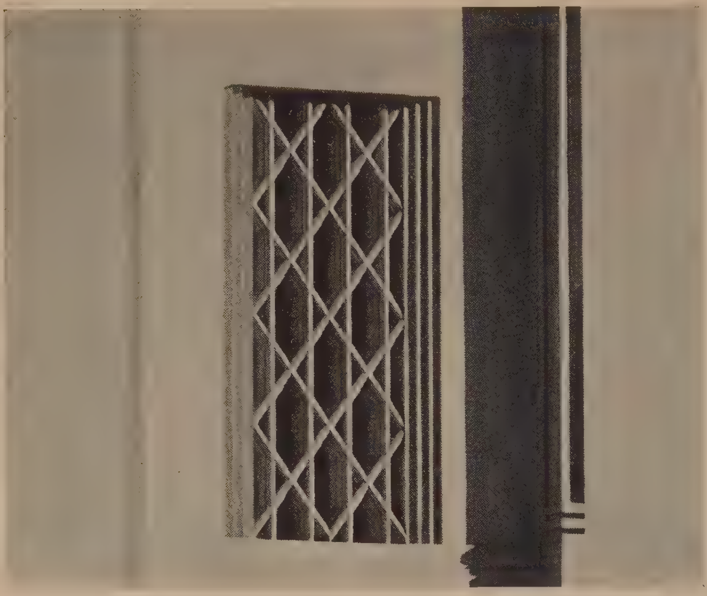


ONE HALF ELEVATION



ONE HALF PLAN

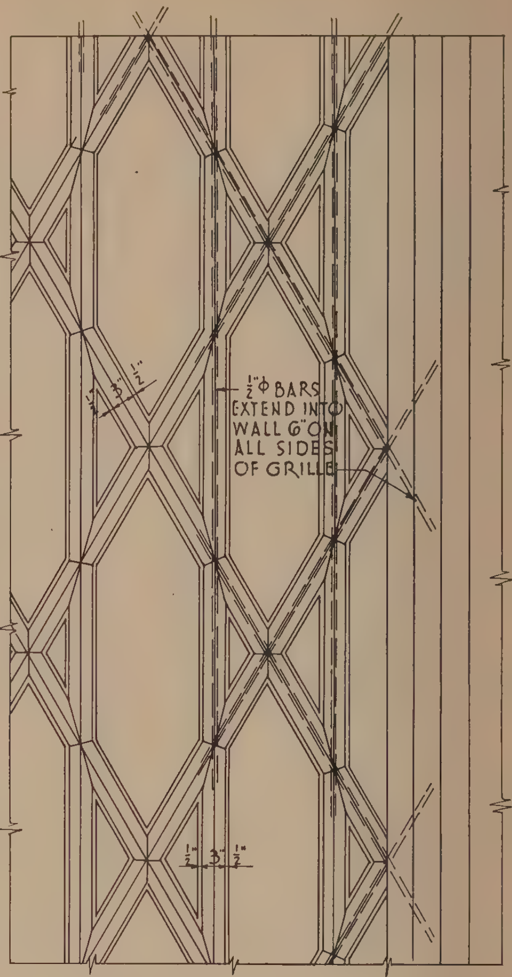
PRECAST GRILLE SET IN WALL
AFTER FORMS ARE REMOVED



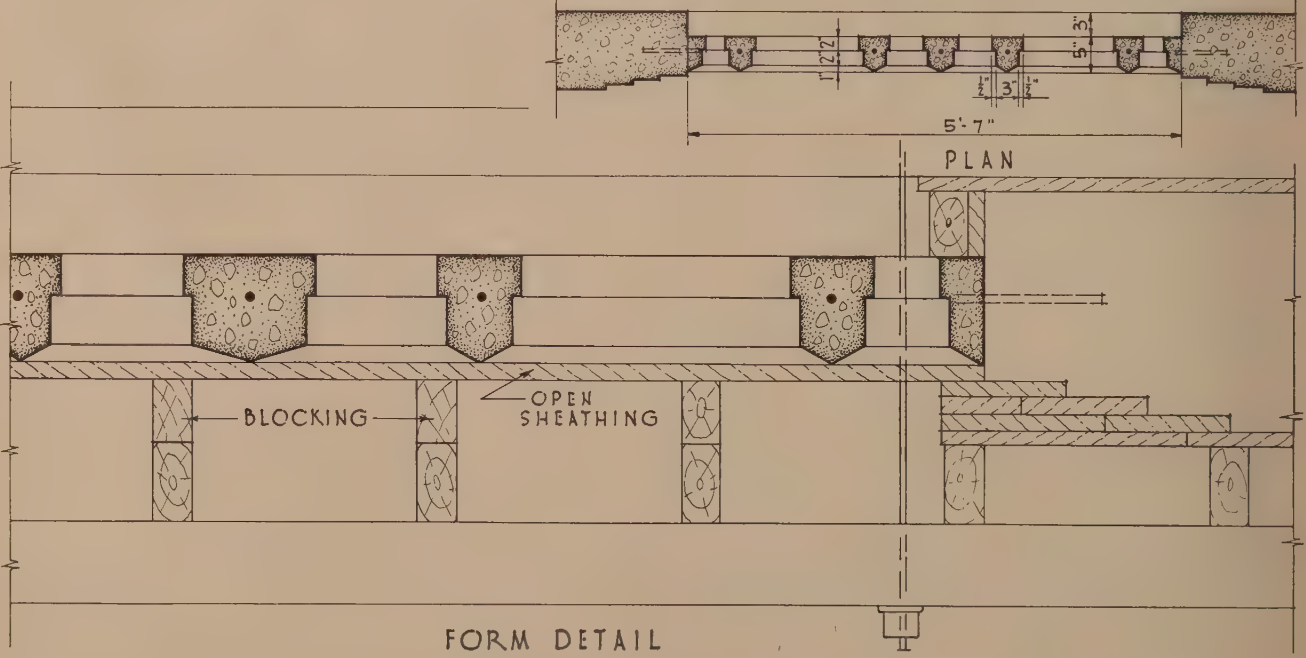
CALIFORNIA FRUIT GROWERS EXCHANGE, LOS ANGELES; WALKER AND EISEN, ARCHITECTS.

has hardened and the forms are removed, or they may be set in the forms and the concrete placed around them. The grille shown on page 19, being of rather intricate design, is a typical precast grille. It is shown set in the wall in a mortar bed after the forms have been removed. The reveal in which the grille is set covers the joint, thereby presenting a neat, finished appearance.

Precast grilles are often set in the forms and the concrete placed around them. Substantial anchorage is thus obtained. This is



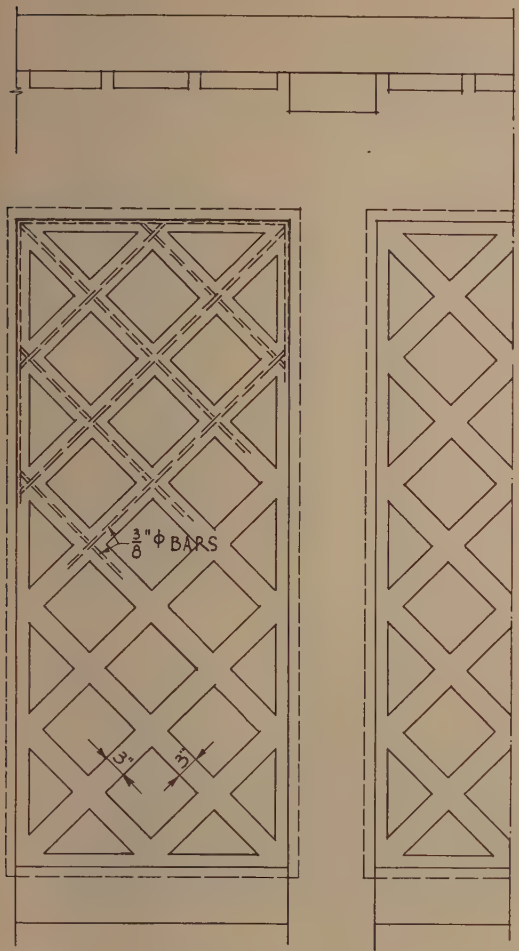
PART ELEVATION



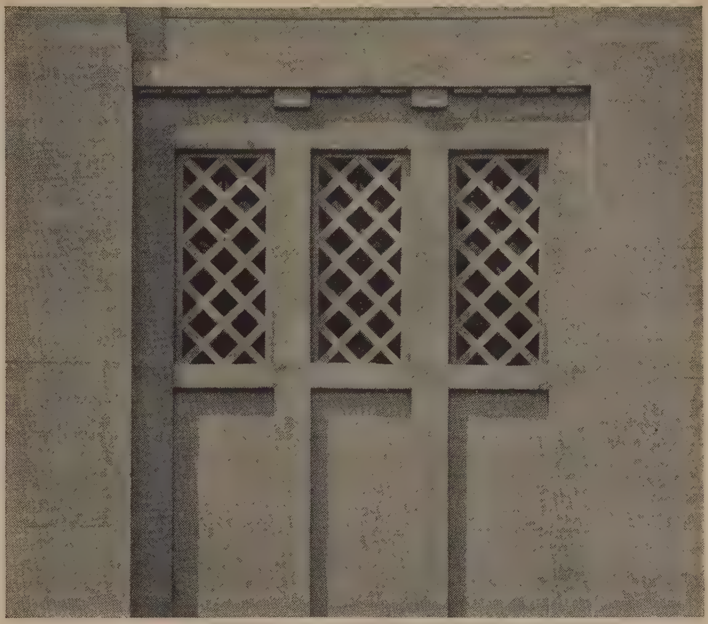
PLAN

FORM DETAIL

PRECAST GRILLE SET IN FORMS BEFORE CONCRETE IS PLACED



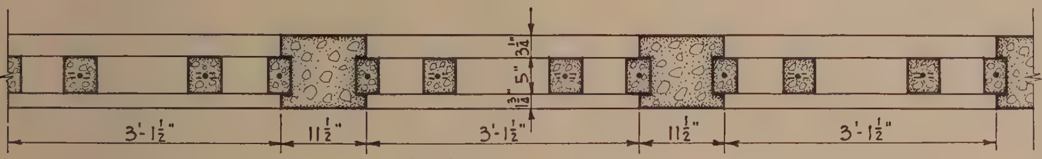
ONE HALF ELEVATION



NORTON MEMORIAL HALL, CHAUTAUQUA, N. Y.; OTIS F. JOHNSON, ARCHITECT.

especially important in earthquake zones. It is also convenient when a grille does not have a completely enclosing member. Typical examples are shown on pages 20 and 21.

A flush grille that is simple in detail, like that illustrated on page 22, is typical of the type which is best formed and cast in place. It is easily formed by attaching boxes of the size of the openings to the wall form sheathing which extends across the large opening for the grille.



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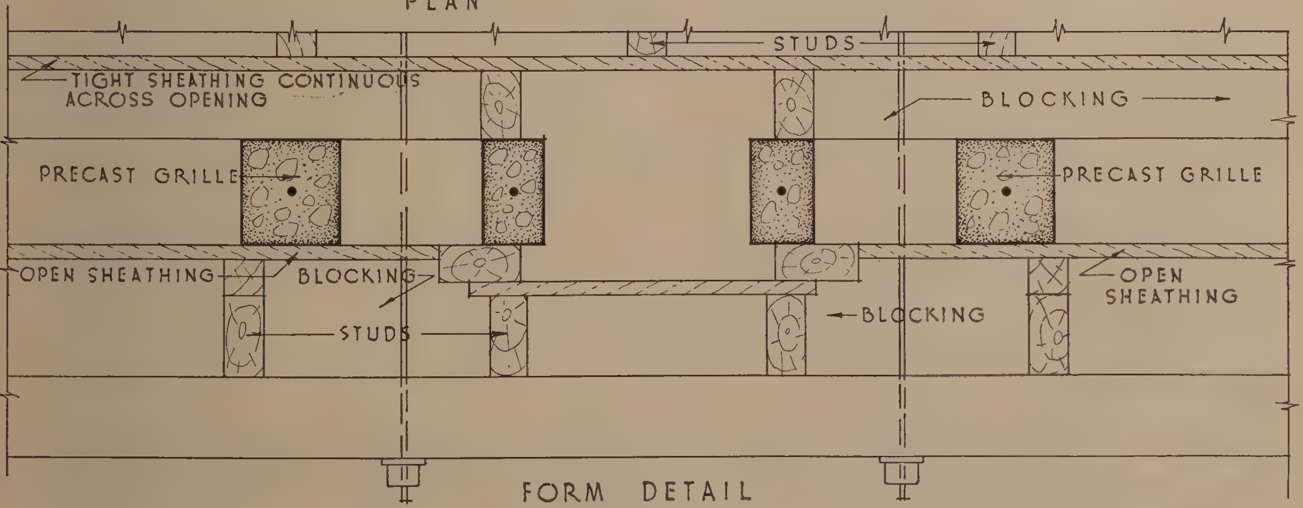
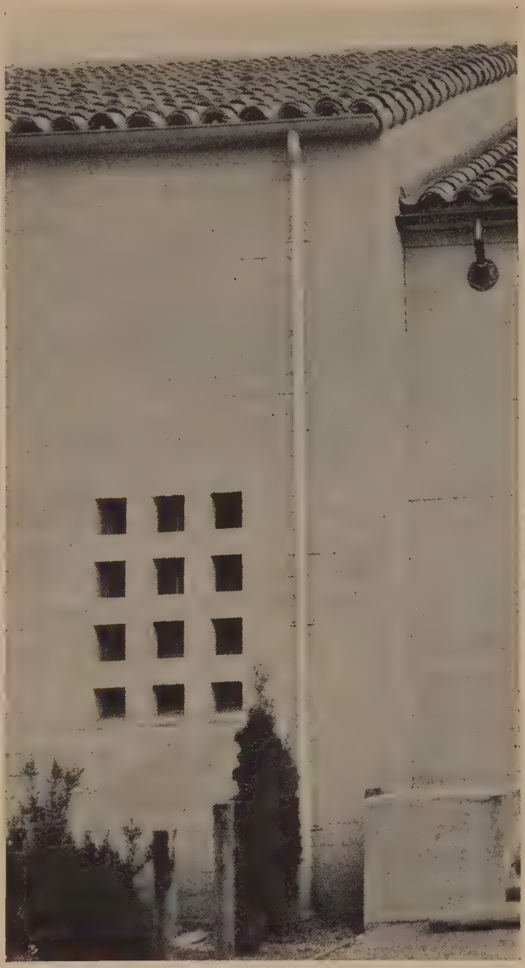
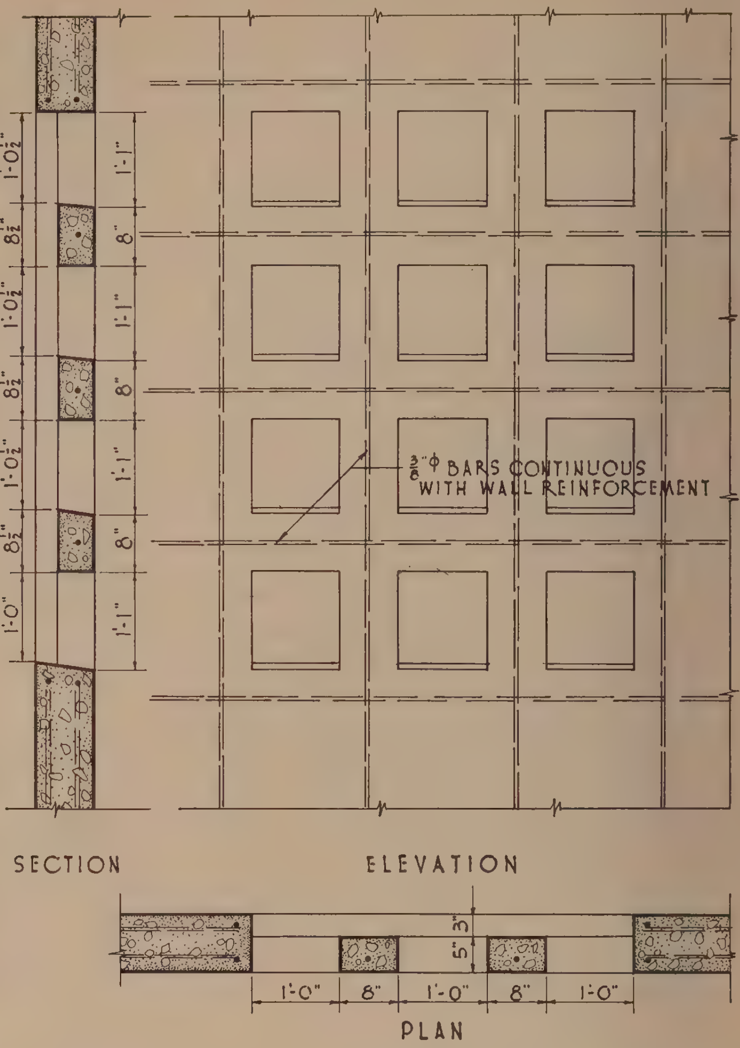


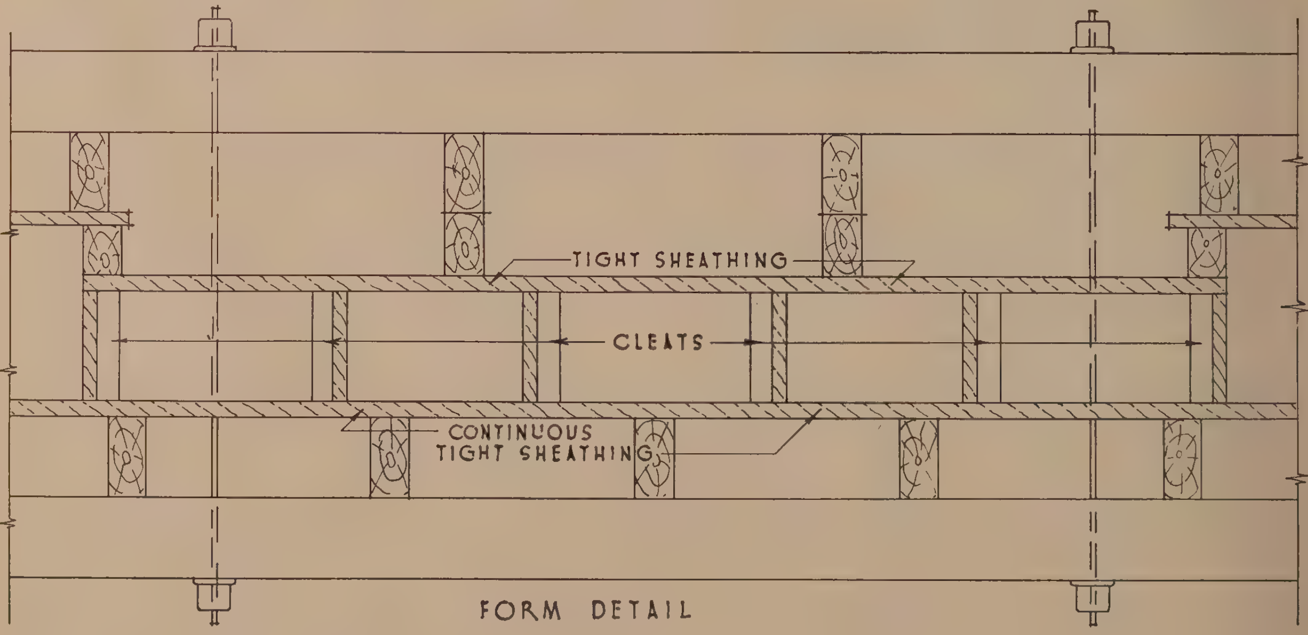
FORM DETAIL

PRECAST GRILLE SET IN FORMS BEFORE CONCRETE IS PLACED



CALIFORNIA SCHOOL FOR THE DEAF, BERKELEY; DIVISION OF ARCHITECTURE, STATE DEPARTMENT OF PUBLIC WORKS.





FORM DETAIL

CAST IN PLACE GRILLE

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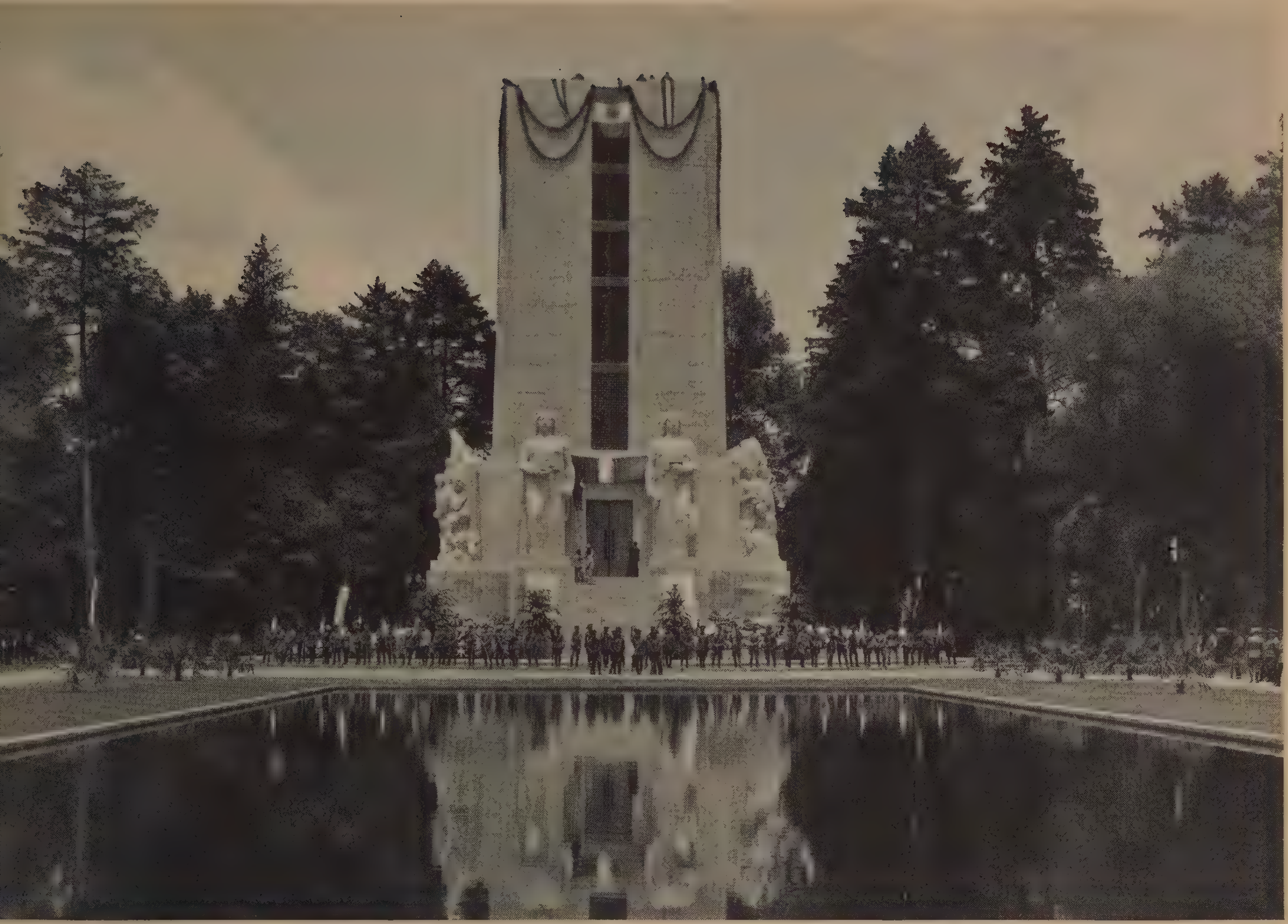


Mirrored in a pool in La Bombilla Park, Mexico City, stands this architectural concrete monument to Gen. Alvaro Obregon, erected in 1935 over the spot on which he was assassinated six years ago. A young Mexican, Enrique Aragon Echeagaray, was the designer.

Mexico Remembers General Obregon

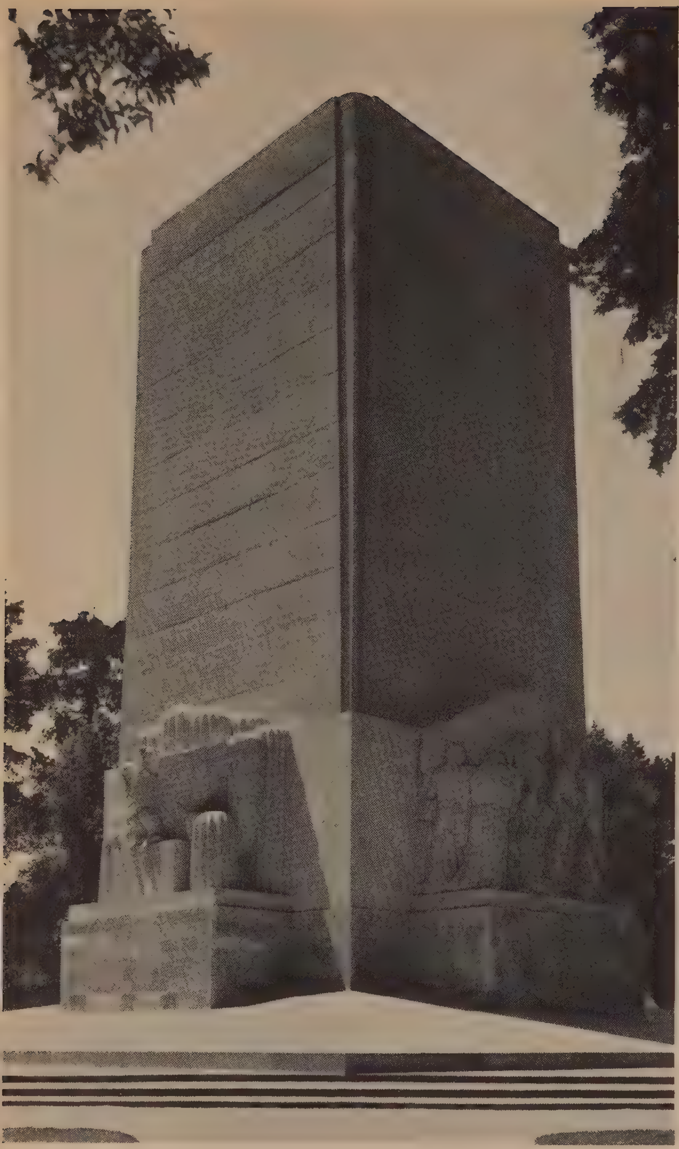
By Enrique Aragon Echeagaray, Architect

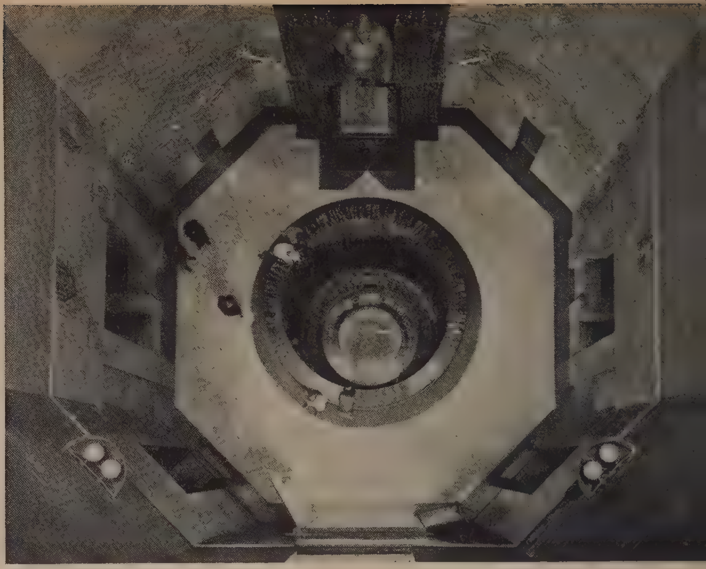
THE monument to General Alvaro Obregon is built upon the exact spot in La Bombilla Park, Mexico City, where he died six years ago—the victim of an assassin's bullet. As a memorial structure, it is intended to symbolize the leader and his influence upon the country. As an architectural work, it was inspired by the man—his strong personality as a great revolutionary; his ideal, the unification of all Mexico; and his objective, to make the wealth of the nation available to all the people.

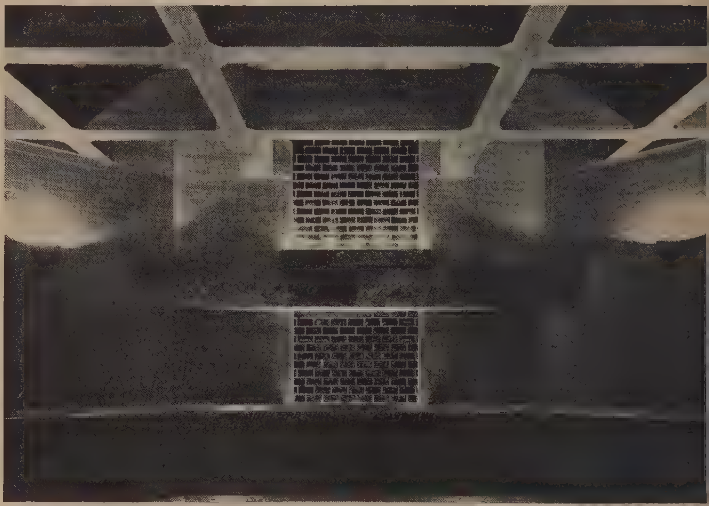
To epitomize the life of General Obregon and his era seemed to require a monument with a strong central motif, relieved by forceful descriptive detail. This was sought in the massive, austere shaft and the heroic sculptured figures.

At the center of the composition and of the legend are two 25-ft. statues at either side of the entrance. The figure at the right represents "Work"; the other, "Fertility." The realization of these ideals is shown by sculptured groups at either side of the shaft—one, "The Sacrifice," depicting the struggle of the people, and the other, "The Triumph." The ensemble, as viewed from the front, is completed by the dominating concrete shaft pierced by a tall, translucent wall rising over the portal and terminating short of the top of the shaft. This window-wall, formed by blocks of crystal prisms interrupted by great structural beams of reinforced concrete revetted with copper, lights the interior.

At the back is a sculptured motif representing the north region of Mexico. It comprises the cactus growth typical of the state of Sonora, and an eagle in flight denoting the







The massiveness of the Obregon shaft is emphasized by the rugged concrete surfaces, left exposed as they came from the forms. Inside, part of the wall is faced with marble. From a balcony one looks down upon concrete sidewalk slabs bearing blood stains of the slain general. A wall of glass rises the full height of the front facade up to the cross-beamed ceiling.

brave spirit of General Obregon rising from the high regions.

The general line of the composition is reminiscent—without being an archeological work—of ancient Mexican art. The silhouette, however, reveals a frank modern spirit, the logical result of expressing the plan of the monument.

The exterior divides itself naturally into three parts. The lower part of the base and stairways are faced with granite from Zacatecas, Mexico; the upper part of the base is faced with Norway granite as a background for sculptured groups of Chiluca stone from the "Pulpit of the Devil" region; and the third and last part which forms the major portion of the monument is reinforced concrete, perfectly molded.

The principal stairway gives access to the interior through doors formed of large plates of chromium nickel. The interior is decorated with colored marbles and granites—some from Italy and others from Mexico. At both sides of the principal entrance are two sculptured figures of bronze which represent soldiers of the revolution. Opposite the entrance stands a 13-ft. bronze statue of General Obregon in an arrangement ending in a sculptured eagle. At either side of this statue are marble slabs with inscriptions relating to the war and the political life of the general. Above the marble plaques is a large mural painted directly on the concrete. Two stairways lead to the crypt in which are preserved, on the original spot, the blood-stained slabs of concrete on which General Obregon died.

A winding staircase and an elevator are located at the opposite ends of the lateral axis. Both extend to a balcony 66 ft. above the entrance from which an imposing view of the interior is offered, and on up to the flat roof which gives a most beautiful view of the great valley of Mexico.

With the exception of the stone facing of the base and

Facings of granite and native stone sculpture in diminishing shades blend into the austere, form-marked grey concrete walls.

sculpture, the entire monument is of reinforced concrete. The construction began in July, 1934. The casting and driving of the concrete piles—200 of them, each about 36 ft. long—required one month. From the lower level of the pile caps, comprising the foundation to the top of the shaft, the placing of concrete required three months—a comparatively short time considering the quantity of concrete involved.

All concrete mixtures for the job were carefully designed and special attention was given to securing a high strength concrete for the piles and heavily reinforced foundation beams. Fine aggregates (used throughout the job) consisted of pit-run sand passing a ¼-in. sieve with a very small quantity of material passing a No. 100 sieve allowed for workability. Gravel used as coarse aggregate (in piles and foundation beams) was uniformly graded from ¼-in. to 1-inch. Slump of the concrete was between 2½ and 3½ inches. The concrete proportions and strengths required for various parts of the work are shown in the table.

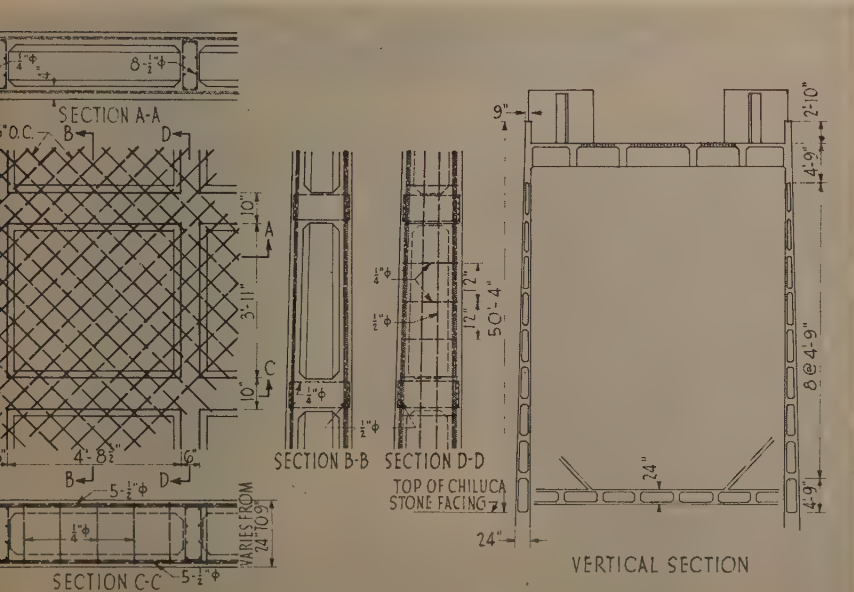
The bearing capacity of the cast-in-place piles was determined by test at the end of 28 days. The method used was rather novel in Mexico. A vertical load was applied by means of a jack of 35 tons capacity. The jack was arranged to bear against a yoke consisting of a short 15-in. I-beam fastened with a ½-in. steel cable to groups of two piles at the left and right of the pile tested.

Between the jack and the top of the pile, two calibrated springs were placed between 1 in. thick plates. The load on the pile was determined by the deformation of the springs.

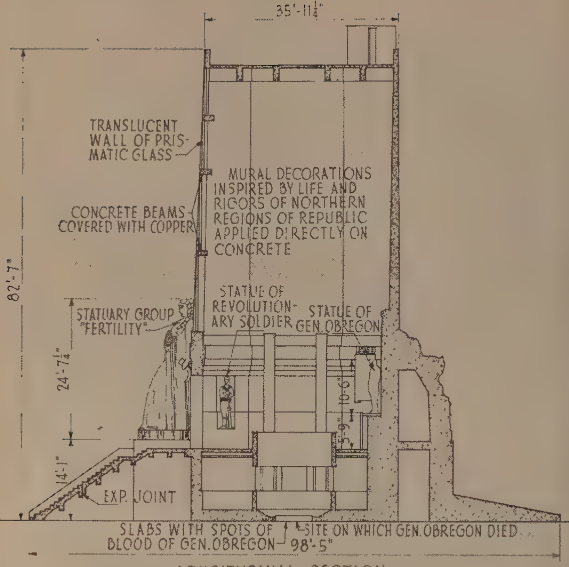
The load was applied slowly, requiring 1 hour and 15 minutes from the start of the test to reach the load of 30 tons. Settlement readings were taken with a level for 5-ton increments of load up to 30 tons. This load was then left on the

STRENGTH AND PROPORTIONS OF CONCRETE USED IN OBREGON MONUMENT

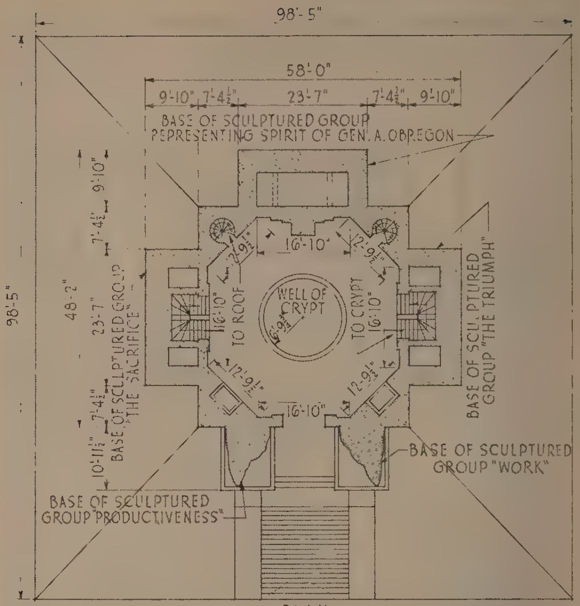
Place Where Concrete is Used	Compressive Strength, pounds per sq. in.	Gallons of Water per sack of Cement, including surface moisture of aggregates	Proportion By Volume: Mix	Proportion By Volume: Per Sack Of Cement		Amount of Cement per cu. yd. of Concrete
			Cement, Sand, Small Gravel Large Gravel	Sand	Coarse Aggregate (Small Gravel Large Gravel)	
Piles and foundation beams.	3,000	6	1:1¾:2¾:0	1¾ cu. ft.	2¾ cu. ft. Small	756 lb.
Mass concrete	1,500	8½	1:2¾:1¾:3¼	2¾ cu. ft.	1¾ cu. ft. Small 3¼ cu. ft. Large	460 lb.
Walls of cellular section, upper beams, stairs, etc.	2,500	6¾	1:2:3½:0	2 cu. ft.	3½ cu. ft. Small	587 lb.



TYPICAL SECTIONS SHOWING CELLULAR WALL CONSTRUCTION


35'-11¼"
TRANSLUCENT WALL OF PRISMATIC GLASS
MURAL DECORATIONS INSPIRED BY LIFE AND RIGORS OF NORTHERN REGIONS OF REPUBLIC APPLIED DIRECTLY ON CONCRETE
CONCRETE BEAMS COVERED WITH COPPER
82'-7"
STATUARY GROUP "FERTILITY"
STATUE OF REVOLUTIONARY SOLDIER
STATUE OF GEN. OBREGON
24'-7¼"
10'-6"
14'-1"
EXP. JOINT
SLABS WITH SPOTS OF BLOOD OF GEN. OBREGON
SITE ON WHICH GEN. OBREGON DIED
98'-5"

LONGITUDINAL SECTION


98'-5"
58'-0"
9'-10"
7'-4½"
23'-7"
7'-4½"
9'-10"
BASE OF SCULPTURED GROUP REPRESENTING SPIRIT OF GEN. A. OBREGON
98'-5"
48'-2"
23'-7"
10'-11½"
BASE OF SCULPTURED GROUP "THE SACRIFICE"
16'-10"
TO ROOF
WELL OF CRYPT
TO CRYPT
12'-9½"
BASE OF SCULPTURED GROUP "THE TRIUMPH"
BASE OF SCULPTURED GROUP "WORK"
BASE OF SCULPTURED GROUP "PRODUCTIVENESS"

PLAN

pile approximately 24 hours or until 6 a. m. the following day, the exact level having been determined the day before, in order to observe any further settlement under sustained load. But on the following morning, no additional settlement was evident and the piles were considered to have adequate bearing power for the design load of 20 tons.

Somewhat lower strength concrete was used in the hollow wall sections and other reinforced concrete work than was required for the foundation beams. A 1500-lb. concrete was considered adequate when used in large masses and not subject to exposure, while a 2500-lb. concrete was specified for the cellular walls and exposed parts. Careful control of the quality was required throughout. Fine material passing a No. 100 sieve up to 10 per cent was allowed for workability in the exposed concrete. Coarse aggregates were divided into two sizes: small gravel, not more than 5 per cent retained on a 1¼-in. sieve and not more than 5 per cent passing the No. 4 sieve; large gravel, not more than 5 per cent retained on a 2½-in. sieve and not more than 5 per cent passing through a 1¼-in. sieve.

The placing of concrete for the exposed surfaces above grade was the object of great attention and vigilance. For architectural expression, it was desired to preserve the form marks—and these are all visible, the construction joints, grain, knots and veins of the pine boards used for forms.

The color of the finished concrete is the grey of common cement without any added pigment. This grey tone is medium in intensity, neither pale nor dark. The three principal parts of the structure follow a trend of descending tones from the dark grey of the Mexican granite, through the lighter tones of Norway granite and Chiluca stone, to the natural grey of the concrete. Viewed from a distance, the entire monument has a bluish tinge.

The monument is about 96 ft. high and covers a ground area of 1,800 sq. ft. It required one year for construction with labor working in three 8-hour shifts each day. Cost of the structure including all installations was about $900,000.

Illumination of Obregon monument, a study apart from mine, is of especial interest, since it has an important role in the symbolical effect of the structure. A great series of reflectors and lamps project light from the roof and spread it twice the total height of the monument. The effect at night is that of a great votive lamp.

Lamps on the roof project light twice the height of the shaft. The effect at night is that of a great votive lamp.

File 10-7-1 Being Letters, Notes and Advices About ARCHITECTURAL CONCRETE

Trying to keep up with all the fine new concrete jobs on the boards from coast to coast would take dozens of picture pages like this. But here are a few of the projects now under construction or scheduled to get under way early this spring.

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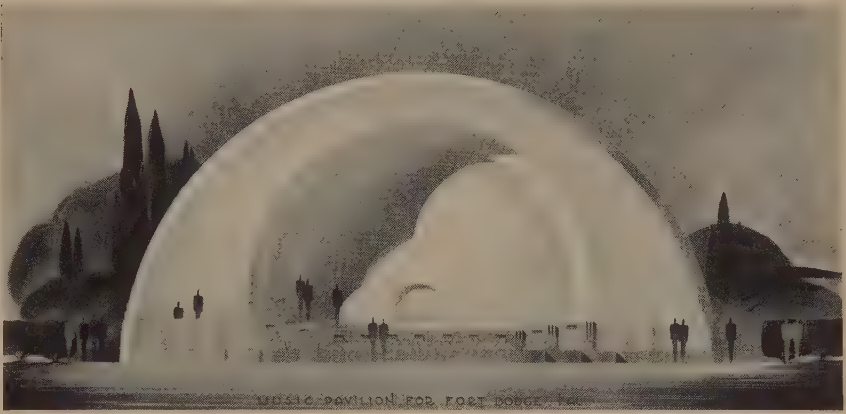
Music Goes 'Round and 'Round

Henry L. Kamphoefner, architect of Sioux City Music Pavilion (ARCHITECTURAL CONCRETE, Vol. 1, No. 3) is wearing out plenty of pencils these days. One of his latest projects, a band shell for Fort Dodge, Iowa, will start construction about March 1. More horizontal in treatment than the Sioux City project, the new pavilion is otherwise similar. Reinforced concrete, cast in smooth-lined forms, rubbed and painted, will comprise structure and finish. Mr. Kamphoefner has also designed a music pavilion for Sioux Center, Iowa, of frame construction, finished with portland cement stucco over metal lath. He is also consulting architect to Carl Ossman, Concordia, Kan. on a $10,000 reinforced concrete pavilion for that city.


MUSIC PAVILION FOR FORT DODGE

Design for Ft. Dodge, Iowa, concrete music pavilion. Henry L. Kamphoefner, architect, Sioux City.

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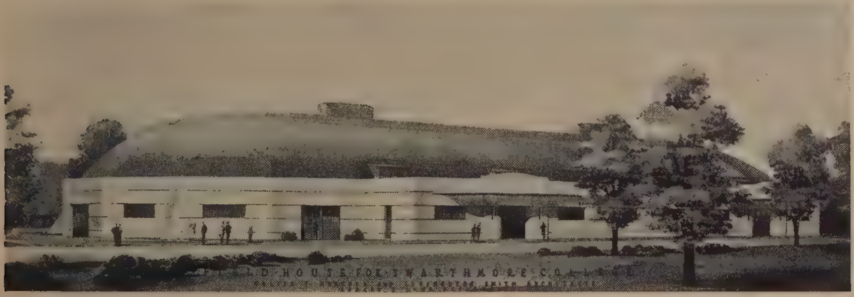
Graphic Arts Building

Project for printing and engraving plant at Galveston, Texas. Joseph Finger, Houston, is the architect.

Work has already started on a modern, generously-lighted printing and engraving plant for Clarke & Courts, Galveston, Texas. Joseph Finger, Houston architect, designed the structure for architectural concrete. One story, 180x220 in plan, the continous fenestration is accomplished by setting concrete wall columns back. Lined forms are used in construction.


FIELD HOUSE FOR SWARTHMORE COLLEGE

Swarthmore College's new concrete field house. Karcher and Smith, architects, Philadelphia.

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Rah, Rah! Swarthmore

Now nearing completion at Philadelphia is a large, modernly-appointed field house for Swarthmore College. Reinforced concrete walls support the roof over an interior clear area of 350x125 ft. Height of the roof at the crown is 30 ft. Karcher & Smith are architects, and Robert E. Lamb, structural designer. Hughes-Foulkrod Co. is the contractor.

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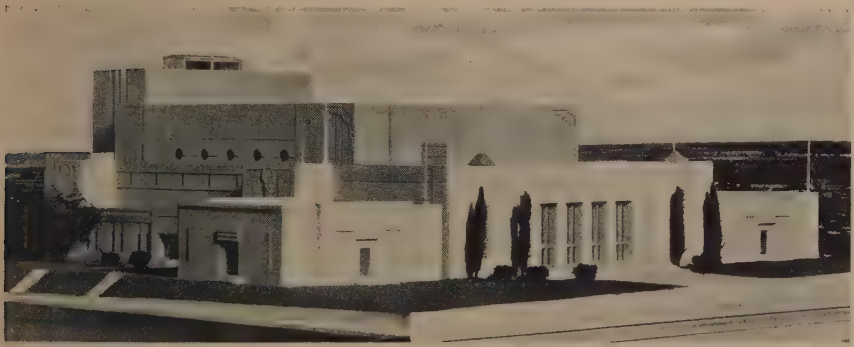
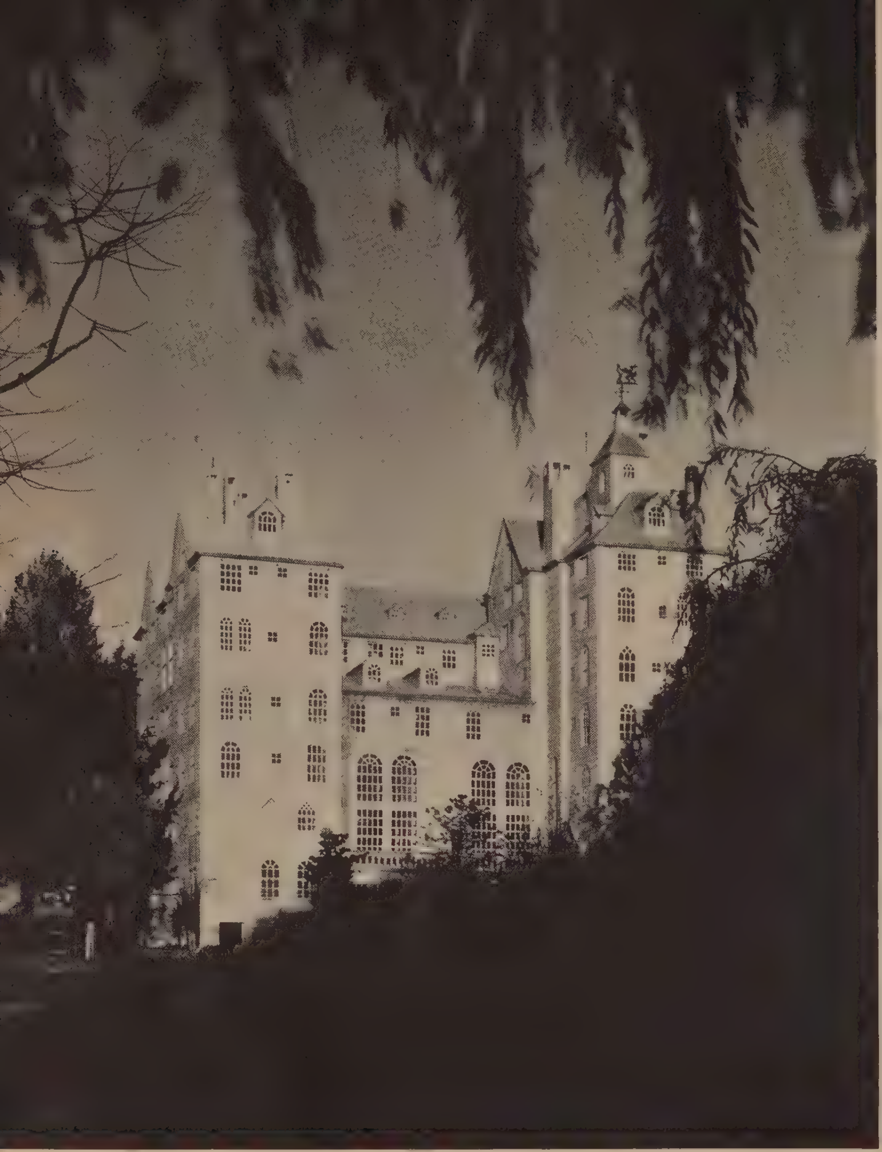
Fresno Auditorium



Model of Fresno, Calif., new municipal auditorium. Designed by Allied Architects of Fresno.

The long quest for a municipal auditorium at Fresno, Calif., will soon be realized with completion of the construction of a fine reinforced concrete structure, to occupy a full city block. Designed to seat 3,500 people at operas, pageants and conventions, the structure comprises a large main floor with movable seats, and a mezzanine. Concrete walls will be finished with a light-colored stucco dash coat. The Allied Architects of Fresno, designers; W. J. Ochs & Treuhitt Shields Co., general contractor.



Bucks County Historical Society Museum, Doylestown, Pa., designed and built during 1914-15-16 by Dr. Henry Chapman Mercer —neither architect nor contractor, but a firm believer that anything he could mold in concrete would stand up forever and forever.

Bucks County Historical Society Museum

By G. F. Wendell*

TOWERING like a feudal baron's castle above the peaceful village of Doylestown, Pa., stands the Bucks County Historical Society Museum—as strange and fascinating a structure as you could imagine anywhere in America. Neither an architectural gem nor an outstanding example of building art, measured by usual standards, it is a great constructional curiosity, more curious than the huge collection of ancient tools, implements, utensils and relics of Indians and early American colonists the museum houses.

Designed as it was erected, shaped and ornamented as need or whim suggested, it is not the product of an architect. Yet it has many architectural qualities, reminiscent of many architectural styles—and in a severe, austere way it is impressive and almost beautiful. No contractor or building expert directed its rise; hence, it contains hardly one square foot of what might, according to modern standards, be called finished concrete. But there it stands, in every bit as good condition from top to bottom as it was when dedicated on June 17, 1916, after three years of construction.

Bucks County Museum—sans architect, sans engineer, sans contractor—is the product of the cash, imagination, brawn and eccentricity of Henry Chapman Mercer, Sc. D., a vigorous and determined man whose great passions in life were historical objects, home-made ceramics and home-made concrete. And the story of these, linked with Dr. Mercer's wish for a permanent home for his beloved historical items, is the story of this uncommon building.

For many years, the Historical Society had collected and exhibited farm and home implements of ancient design, picked up in cellars, garrets and barns all over the Pennsylvania countryside. At the same time, Dr. Mercer was building a private collection of similar items, and since he was a man of wealth, his collection grew faster and outstripped that of the Society. For some time, the two collections were friendly rivals, but both were poorly housed. Then Dr.

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*Portland Cement Association, Philadelphia.

Mercer decided that his collection should be permanently protected; and he undertook the erection of a combination home and museum, resulting in the quaint reinforced concrete structure called "Fonthill."

In building "Fonthill," Dr. Mercer added concrete to his hobbies of collecting relics and making ceramic tiles. Here he lined the forms for his great rooms with highly colored and glazed tiles; but his experiments in forming concrete led him to weirdly-spiraled stairways, hung balconies and strangely-shaped piers and columns. The plasticity of concrete fascinated him. He tried and successfully erected vaulted ceilings, using the basement of "Fonthill" as his concrete laboratory. He knocked the heads out of kegs, piled them one on another as forms for undulating columns. He even formed columns in iron pipes, sliding the pipes off the concrete after a certain stage of hardening.

Before "Fonthill" was completed, Dr. Mercer got the idea for a much larger, finer and more imaginative structure. So he went to the Historical Society with a proposal that it merge its collection with his in a new, large building that he would finance and erect, the structure to become the property of the Society upon his death. This magnificent offer was accepted, and for his generosity Dr. Mercer was appointed curator of the museum as well as builder, and work commenced. This was in 1914.

At the time he planned the museum, Dr. Mercer stated: "The building will be secondary to the collection." And striking proof of the carrying out of this decision lies in the arrangement of galleries, the varying floor levels and the uneven and oddly-shaped fenestration. The building was literally "built around" the collection—the ceilings low here, because there are no high objects; but higher there, to accommodate a tall wagon. An old cider press, placed on the second floor before the walls were erected, protrudes its upright screw-threaded pole right through the third floor above, a convenient opening in the concrete being left for that purpose. It is a purely functional building, conforming to its contents, with windows placed in walls when and where light was wanted. From foundation to cornice, the building was designed as it was built; but the roof was given "consideration from a decorative point of view."

The concrete cast-in-place roof was finished with a broom.

If the visitor is privileged to go through the building under the personal guidance of Horace M. Mann, present curator of the museum, he can spend many an engrossing hour. For Mr. Mann not only knows his collection like a psalm, but is filled with data, lore and legend about the structure and its builder, which he will unfold with amazing and charming detail if properly plied with questions. The author is indebted to Mr. Mann for most of the facts and some of the fancies recorded here.

The structure rises 115 ft. to the weather-vane, and is 97x71 ft. in plan. It is concrete from cellar to roof inclusive, with foundations of various thicknesses down to bedrock. Walls, floors, roof, columns, pilasters and even window sashes are of reinforced concrete.

The interior comprises a center court surrounded by three galleries, and there are 33 rooms and 36 alcoves to house the collection, most of which—spades, forks, knives, mill stones and gadgets—hang from the ceiling on hooks. There are 297 windows, placed at random, varying from 1½ ft. square to 10 and 15 ft. high with round heads.

The museum was designed and the entire job erected

Dr. Mercer, museum curator and pottery maker, got his first experience in monolithic concrete construction by building his own home, "Fonthill." This structure was intended for a combination museum and house, the right part of the building being a concrete envelope over a 160-year-old hewn log house the good doctor wished to preserve. "Fonthill" was started in 1907 and completed in 1912.

The window sashes throughout were formed in cross-shaped sections, bound together with cement mortar after glass was fitted.

under the personal supervision of Dr. Mercer. No dilettante, despite his academic and cultural tastes, Dr. Mercer donned overalls every day of the construction, puddled in concrete, tinkered with forms and drove his men to great efforts and strange results. Only one skilled worker was on the job—a Russian-Jewish carpenter—all others being recruited from day laborers resident in and about Doylestown.

All mixing of concrete used up to the first floor was done by hand. Thereafter, a small trough mixer of half-bag capacity was used. According to William A. Labs, now a contractor at Pitman, N. J., (whom Dr. Mercer made foreman of the job at the age of 20) a 1:2:4 mix was used in all structural parts, and a 1:2½:5 mix in certain walls. Spading was done solely with shovels, and Labs says none of the batches was "real wet," except in stairways where spirals and unusual forms were used. The accuracy of Mr. Labs' memory is attested by the enduring quality of the concrete, which shows not the slightest trace of weathering.

Forms, for the most part, were built of 10 and 12-in. sheathing, but at many points odds and ends of boards of various widths and thicknesses were employed, as well as pieces of sheet tin. Several instances of the latter may be seen in arches at staircase turns. Baling wire was used to hold the forms together, and the ends may still be seen projecting from the walls, columns and pilasters. For window sashes, plaster of paris molds were made in the shape of a large plus sign to form the corners of each pane section. When panes were set in these corners, the various cross-shaped units forming the whole window were bound together with cement mortar.

The roof was built with inside forms only, which were moved up as the job progressed. The roof finish was applied with brooms and today it looks somewhat like the flow of lava down a hillside. Unprotected by membrane waterproofing and without trace of an integral waterproofer, this crudely constructed roof has guarded the treasures within from the ravages of weather for twenty years.

During the early part of the work, iron bars, railroad rails and many other sorts of metal were used for reinforcement. Later, careful selection was made of ¾-in. bars, most of them round. Sections of rails were placed the full lengths of eaves, ~~and a~~ considerable amount of Pittsburgh wire fencing was used in all the walls. Forms for pilasters and columns were built as they went up.

Dr. Mercer's method of building vaulted ceilings was unique. He erected a platform under the proposed vault and heaped dirt on it, rounding and smoothing it off by hand. Then over the mound he poured cement grout, letting it harden a bit before placing mass concrete over it. After days or weeks, depending upon his empirical method of judging the state of the concrete, the platform was knocked out from under the dirt, letting it all fall away from neatly-rounded but very rough-cast vaults.

One day during construction, some professional men came to the site to watch operations. One of the visitors saw that a corner of the building was greatly out of plumb, sloping outward from the building line. Dr. Mercer pooh-poohed this criticism, saying: "What difference does that make? It's all solid construction." But he erected forms from the point of the bulge down to the ground, filling them in with concrete, and thus trued up the wall. This was his only concession to public or expert opinion. He had his own ideas, and concrete as he used it has not failed him.

Dr. Mercer, always ready to write books and pamphlets about his activities, wrote one treatise entitled, "Concrete for Concrete's Sake." He recognized the possibilities of the material and thought it should be used for its own sake.

In all, four structures stand to attest the ingenuity of the tireless doctor and to uphold his confidence in reinforced concrete. They are the museum, his home "Fonthill," a large garage, and a ceramic tile shop. None of them is an architectural masterpiece, but each has the charm of oddness and peculiar beauty that marked everything Dr. Mercer touched.

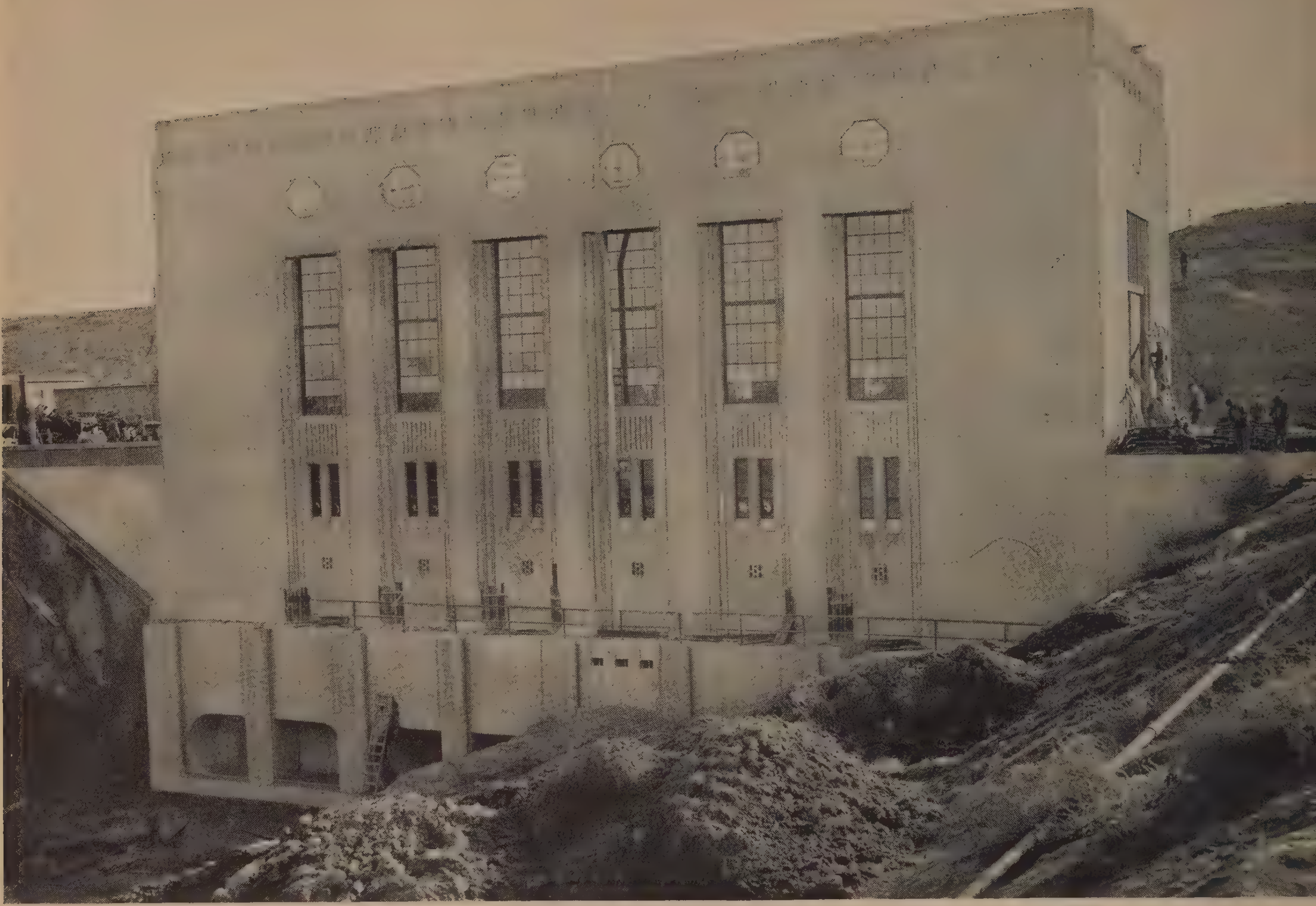
Windows were placed where light was needed.

Dr. Mercer apparently didn't mind where the cold joints came—or how rough the concrete.

Portrait of a patriarch.

Monolithic stairway adds a pleasant touch to "Fonthill."

Floor levels, ceiling heights and arrangement were determined by the size and importance of material to be exhibited.



Nearing completion at North Platte, Neb., is Sutherland power house, part of the $10,000,000 North Platte River irrigation and power project. Molds for dentil band below the parapet and decorative detail over windows are shown in place. Donald D. Price, chief engineer; Parsons, Klapp, Brinckerhoff and Douglas, consultants.

Sutherland Project Power House

By Knox F. Burnett*

THE Sutherland Project is a $10,000,000 PWA project to utilize the waters of the North Platte River, in central Nebraska, for irrigation and water power. The power house part of the program, now nearing completion, is being built of reinforced concrete at a site just south of the city of North Platte, Neb.

A development of this magnitude and character always depends on concrete as a natural medium for the construction of most of its engineering structures. This has been done at North Platte, in the dam diverting water from river to canal, the siphon under the South Platte River (14 ft. inside diameter and 7,500 ft. long), bridges, checks, canal lining and work of similar nature. Since a power house should symbolize the power and energy developed within its walls, it was also natural that the designers should turn to concrete as the architectural medium for the structure. To this end the design was made, using plain surfaces and simple lines, with deep reveals and window recesses accenting the strong verticals growing out of the deep cut of the tailrace.

When completed, the power house will contain two 18,500 H.P. Francis type turbines generating 15,000 kilowatts each. The power drop to the water wheels is 205 ft. gross head. The building comprises a main generator room, 42x117 ft., with a wing containing control switch gear and auxiliary power rooms. Below the generator room is the turbine room, giving access to the turbine pits at a still lower level and also providing space for shops and transformer repair. A 70-ton traveling crane is installed in the generator room to aid in the erecting and servicing of electrical equipment.

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*Assistant Office Engineer, Platte Valley Public Power and Irrigation District.

It is 40 ft. from generator room floor (natural ground level) to the bottom of the footings which are 19 ft. below ground water. The contractor dried up the site by putting an earth plug in the tailrace and pumping out seepage water.

The foundations rest on sandstone which offers structurally sound footings and materially reduces the inflow of ground water. A concrete seal was, however, placed over all of this foundation, and the footings were placed in the dry above the seal. A solid mat foundation was then placed under each turbine block, and massive blocks of concrete were carried around the draft tubes and turbines and up to the generator floor. A horizontal thrust of 1,000,000 lb., due to the hydraulic pressure against the butterfly valves, is transmitted by concrete walls into each turbine block.

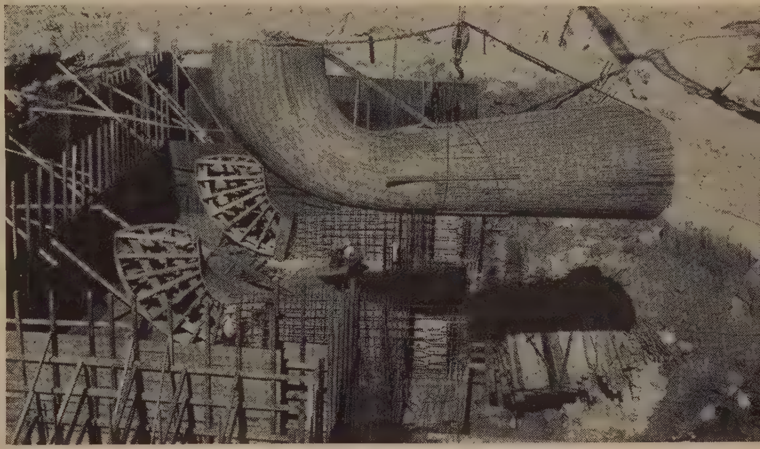
Draft tubes, of the elbow type with vertical splitters, each develop two outlets to the tailrace. These draft tubes are very complicated in shape. Each starts as a cone, directly under the water wheel, turns horizontally and spreads into an oval, finally splitting into two outlets. The contractor built the forms for these tubes in half sections, carrying out the work on a platform on which were marked carefully laid out templates.

Frames were built at each critical section with intermittent frames to space them at a maximum of 2-ft. centers. These frames were covered with a layer of narrow, 1-in. strips of wood forming a warped surface. This first layer was then covered with a similar layer of strips, carefully shimmed to exact dimensions. After sanding and pointing cracks, the forms were lifted, half at a time, and lowered, braced and tied into position on the mat foundation. Concrete was placed around these forms in the usual manner, extreme care being taken to vibrate the concrete on the under surfaces of the form where maximum wear from water would result.

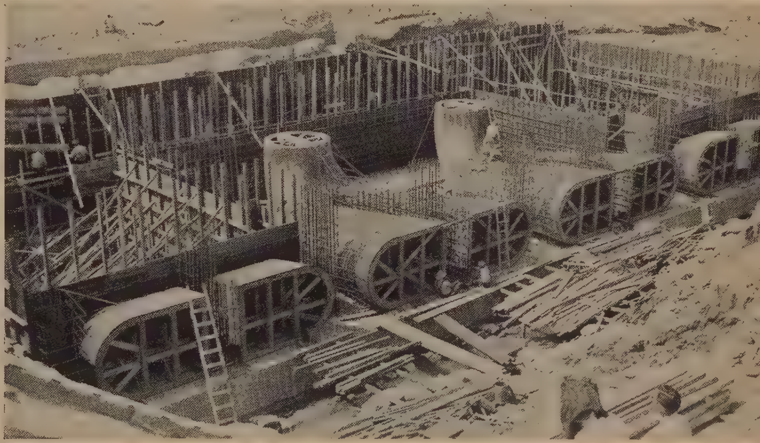
All exterior walls and all finished parts of the building were formed with ⅝-in. plywood, backed up with studs and wales in the usual manner. Care was taken to obtain a symmetrical arrangement of joints. The joints are made as inconspicuous as possible; but where they are visible they form a regular pattern.

Concrete used on the job was a mixture of sand and gravel, sand varying from 55 to 45 per cent, with seven sacks of cement to the yard. Water was closely controlled to give a consistency permitting hand spading on exposed surfaces. Where large volumes of concrete occurred, they were vibrated with internal vibrators. Very little tolerance in water was permitted, and as a consequence honeycombing and sand streaks were avoided. Practically no patching was necessary.

The Sutherland Project is being carried out by the Platte River Valley Public Power and Irrigation District, through its own engineering forces, with Donald D. Price as chief engineer and general manager. Parsons, Klapp, Brinckerhoff and Douglas are consulting engineers.

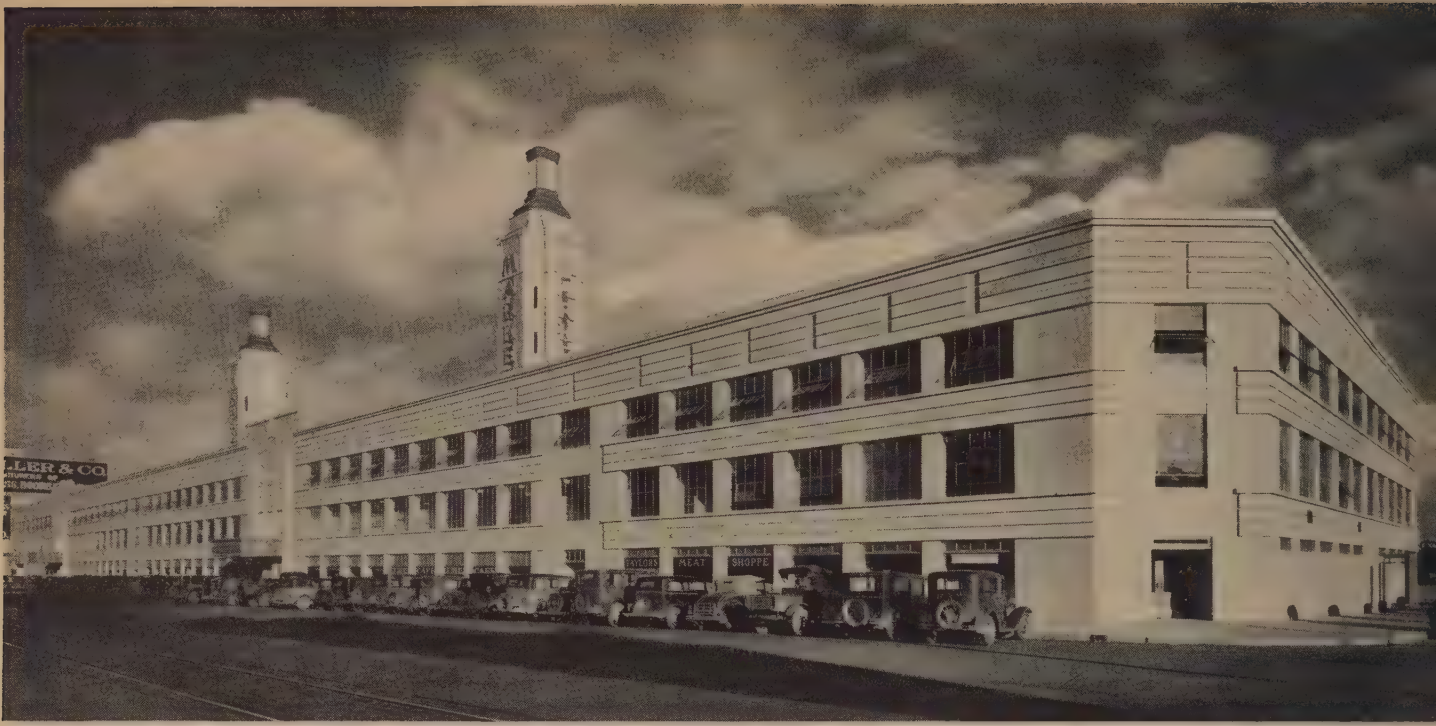


Moving half sections of draft tube forms into place.



Tube forms in place, reinforcement is set up for turbine foundation.

Mass concrete surrounds the draft tubes and turbine base.



The opening of this splendid concrete market building in 1933 eliminated a serious traffic and public health hazard in downtown Portland, Ore. Privately owned with space leased to concessioners, the structure was designed by Lawrence, Holford & Allyn, architects. Howard Rigler was structural engineer and Ross B. Hammond, Inc., the general contractor.

Portland Public Market

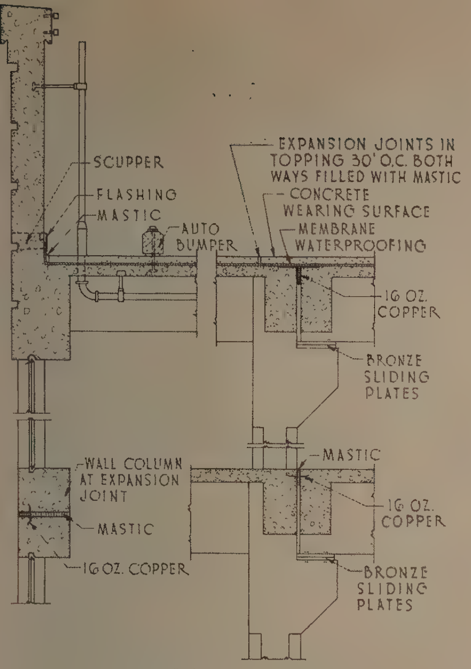
PRIOR to the building of its great new Public Market, the city of Portland, Oregon, suffered seriously from congestion in the downtown section where marketing of fruits and farm products, groceries and meats was largely centered. This district, extending for several blocks along Yamhill Street to the edge of the main shopping district, not only was thronged with crowds of customers, automobiles, trucks and wagons, but sidewalks were frequently lined with crates, boxes, sacks, poultry and green vegetables. Such conditions, in a city laid out with small blocks and rather narrow streets, stagnated traffic and obstructed efficient conduct of market business. For years citizens had felt that "something should be done about it."

It was from such beginnings that the present fine market structure had its inception. The completion of the Laargard waterfront improvement, with its permanent wall along the west side of Williamette River and the filling-in of areas behind it, created some 20 blocks of new, usable land closely adjoining the old market. This property, people felt, was the answer to the long need for a more healthful and sanitary market district.

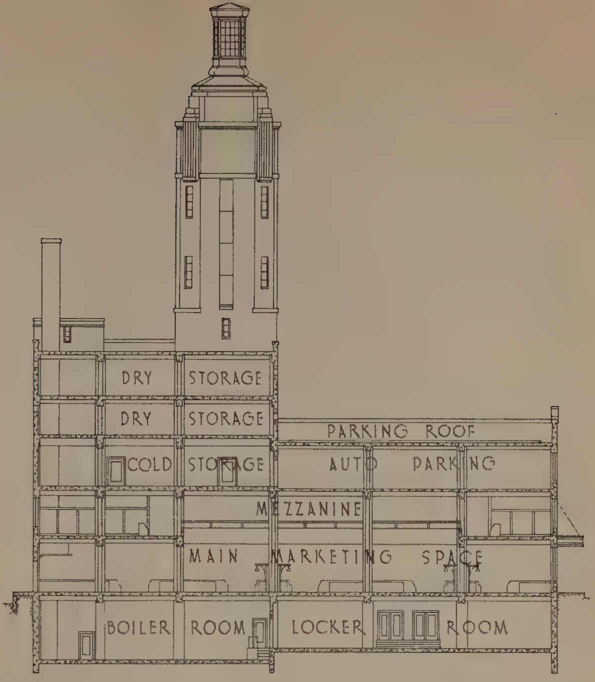
Thus, it was not difficult for city fathers to come to an agreement with the Public Market Co. of Portland, a private concern, under which the latter would undertake the erection and operation of a new central market. Everything was ready in early 1929 for immediate construction, when the stock market folded up and money went into hiding. This unpleasantness, however, only delayed the Portland project, for in 1932, with the aid of an RFC loan, the market was started, and by May of 1933 was completed.

The market building, occupying a plot 616x137 ft. along the river front, is built entirely of reinforced concrete.

Structural concrete is exposed throughout most of the interior.



DETAILS OF ROOF PARAPET AND EXPANSION JOINTS



TRANSVERSE SECTION

Decorative detail, except for ornamental devices on the two 150-ft. towers, was limited to long molded bands—conforming to the horizontal motif of the structure—which were formed with the concrete walls. Exterior walls were given one coat of cement paint for finish treatment, and the interior, except for the auditorium, market office, and several other rooms which were plastered, is exposed concrete painted.

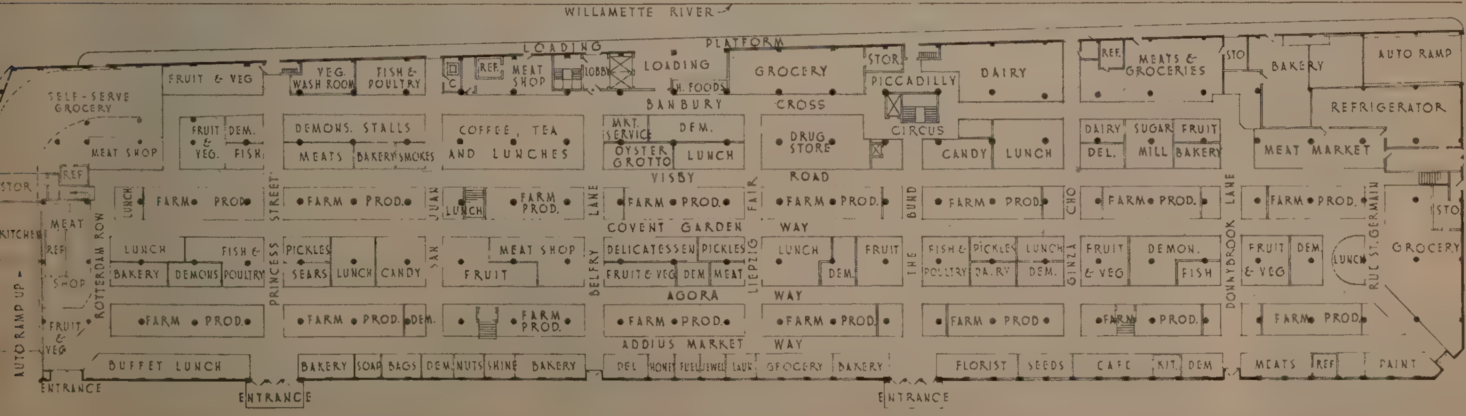
Three vertical expansion joints, closed with mastic and completely weatherproofed, divide the structure into four separate concrete monoliths. Footings are soil bearing, good foundation conditions eliminating the need of piles. All floors are concrete and the basement floor is especially designed to resist the upward pressure of ground water.

The structure comprises two floors, mezzanine and basement with most of the stalls, stores and concessions, which occupy 46,000 sq. ft., being located on the first floor and mezzanine. But the Portland Market has other important uses for its space. Parking problems, which annoy customers and worry the proprietors of most city markets, are absent here. Ramps lead from the street to the second floor and roof, where from 650 to 1,000 cars may be parked free of charge while families shop in the stores below.

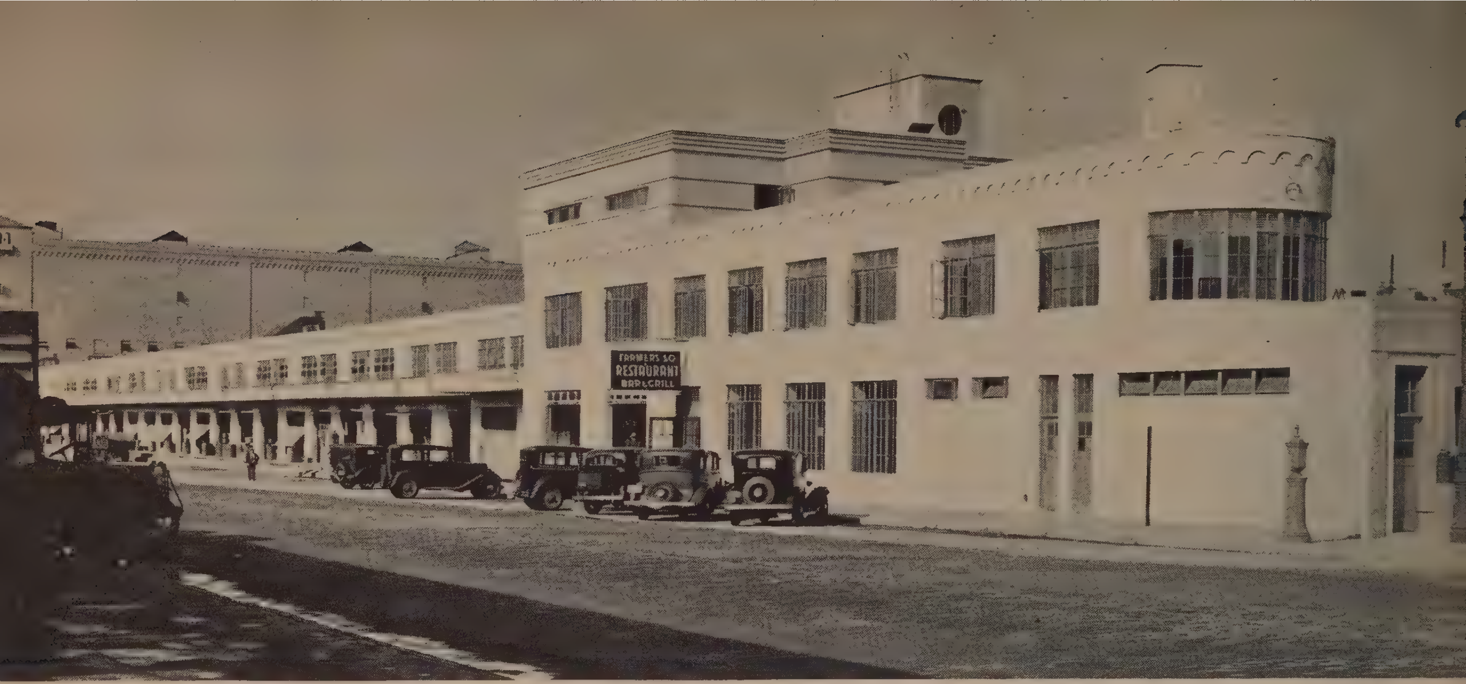
For further convenience of customers, the market offers the "Handy Ann"—a refinement of the market basket. Reminiscent of a perambulator, this deep wire basket, mounted on wheels, is supplied to each customer on entering the market. Aisles are wide enough for buyers to push their acquisitions ahead of them from stall to store, from grocery counter and meat shop to cigar stand or beauty parlor. At the completion of the shopping tour, the customer checks his "Handy Ann," rides the elevator up to the roof, and there finds his purchases neatly packaged and delivered to his waiting car.

A large number of the concessions were leased prior to construction, so that special requirements for different types of stores could be built in. The numerous farmers' produce stalls are rented by the day.

The spacious layout and efficient arrangement of stalls and equipment have proven very satisfactory to merchants, who have been using increasing amounts of space since the market opened in 1933.



FIRST FLOOR PLAN



One of the new Bronx Terminal Market Buildings completed early in 1935. Albert W. Lewis, Samuel Oxhandler and John D. Churchill, associated architects; Turner Construction Co., contractor, New York. All the market structures are concrete.

The Bronx Terminal Market

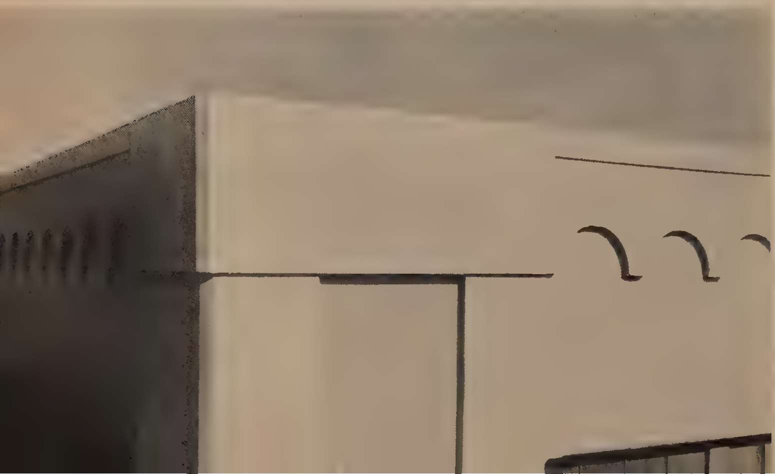
A Series of Merchant Stores for New York City

By George E. Horr*

THE decision of Mayor Fiorello H. La Guardia and William Fellowes Morgan, Jr., Commissioner of Public Markets, Weights and Measures, that New York City should have a thoroughly modern terminal market in which the merchants might display and market produce, led to the development of the new Bronx Terminal Market.

Mr. Morgan, in commissioning Albert W. Lewis, Samuel Oxhandler and John D. Churchill as associated architects for the project, selected men who fully realized the architectural possibilities of concrete. Such vision made it possible for them to design a group of buildings which, although strictly utilitarian in character, nevertheless are removed from the usually unattractive "factory" type to a class of structures having considerable architectural merit. This was accomplished by simple treatment of masses, giving due attention to development of lights and shadows by projecting elements on the vertical surface of the structures.

Continuous arched detail relieves parapet wall masses.



The first group of buildings erected consists of 47 merchants' stores, each 40x73 ft. in plan, two stories in height; a restaurant building; comfort stations; farmers' market sheds and paving. These buildings are located between 150th and 151st Street in the Borough of the Bronx, with merchants' stores facing on Exterior Street. The first group, on which bids were taken in September, 1934, was awarded to the Turner Construction Co. of New York City on its bid of $570,000. Work started about October 1, the units being substantially completed by May 1, 1935.

On April 3, 1935, bids were taken for the construction of three additional buildings, each two stories high—one 53x400 ft. in plan to include merchants' stores No. 69 to

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*Contract Manager, Turner Construction Co.

78 (see plot plan); another 60x300 ft., including also a mezzanine, to house stores No. 59 to 68; and a third building, triangular in shape, to house stores No. 49 to 58 inclusive, a bank and a farmers' hotel. This second contract, totalling $359,226, was also awarded to the Turner Construction Co.

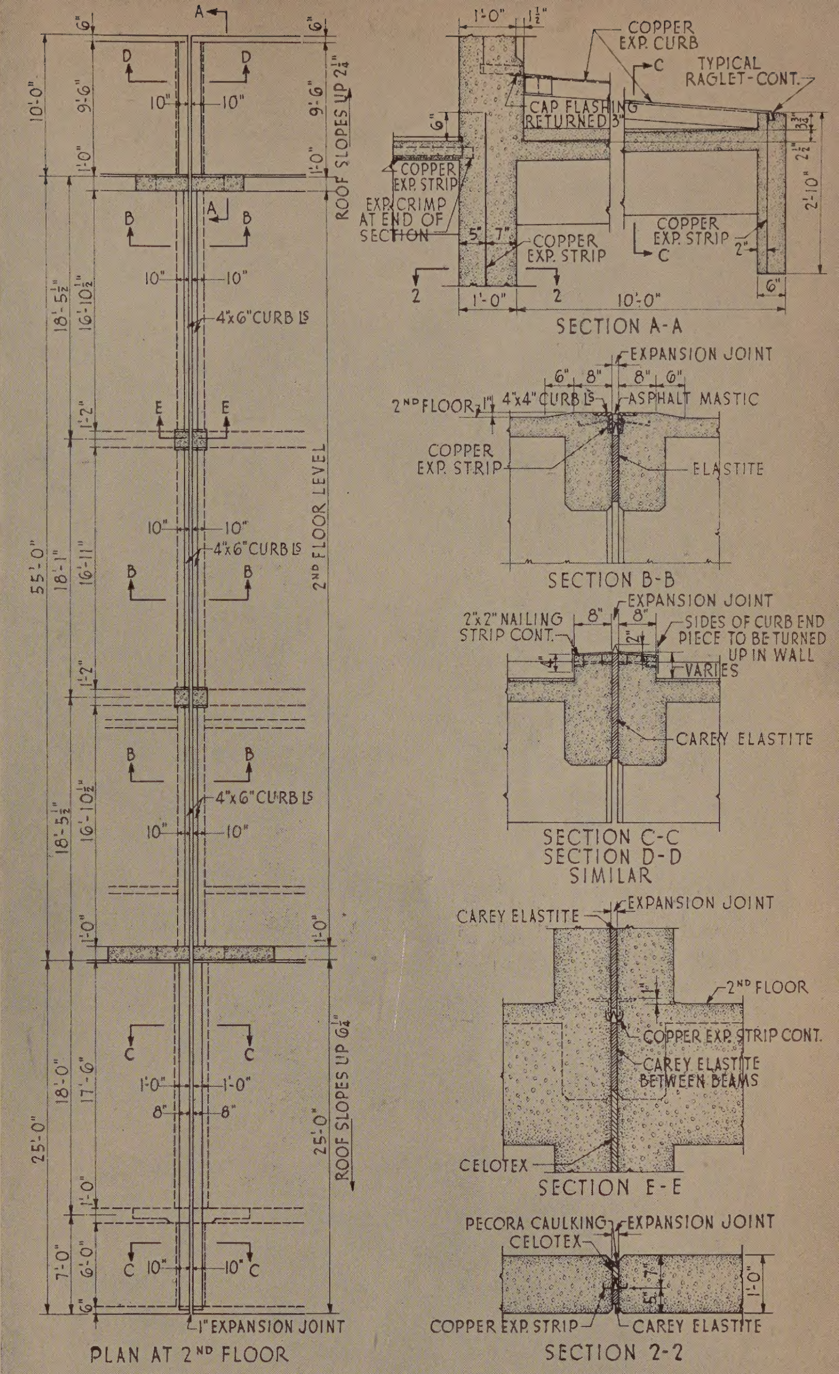
The original contract involved the placing of approximately 1,290 cast-in-place concrete piles by the Raymond Concrete Pile Co., each averaging 46 ft. in length. First floors are concrete placed on fill and flush with the tops of the concrete pile caps. Expansion joints were provided between the floor slabs and pile caps, and also along all column lines.

The entire superstructure of the project is of monolithic concrete, the walls being generally 12 in. thick. The second floor and roof are reinforced concrete of one-way slab, beam and girder construction. Cantilevered canopies at front and rear project, respectively, 7 and 10 ft. over the loading platforms. Story heights are 14 ft. from finished first to second floors, and 10 ft. from finished second floor to underside of the roof slab. All exterior windows are rolled steel, glazed with double-thick American glass. Most of the interior partitions are of cinder concrete masonry units, the exceptions being fire walls, which are 8-in. brick.

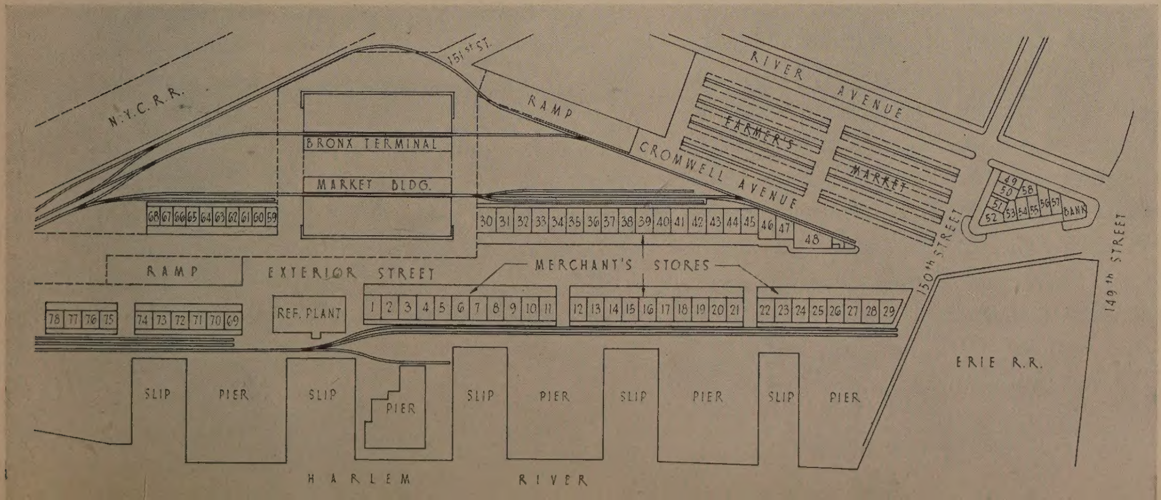
Construction for the three buildings in the second contract is similar to that of the first group, except that the first floors on fill are reinforced and self-supporting, with the fill used as the form. The unit housing the bank has a basement in which the floor slab is laid directly on the ground.

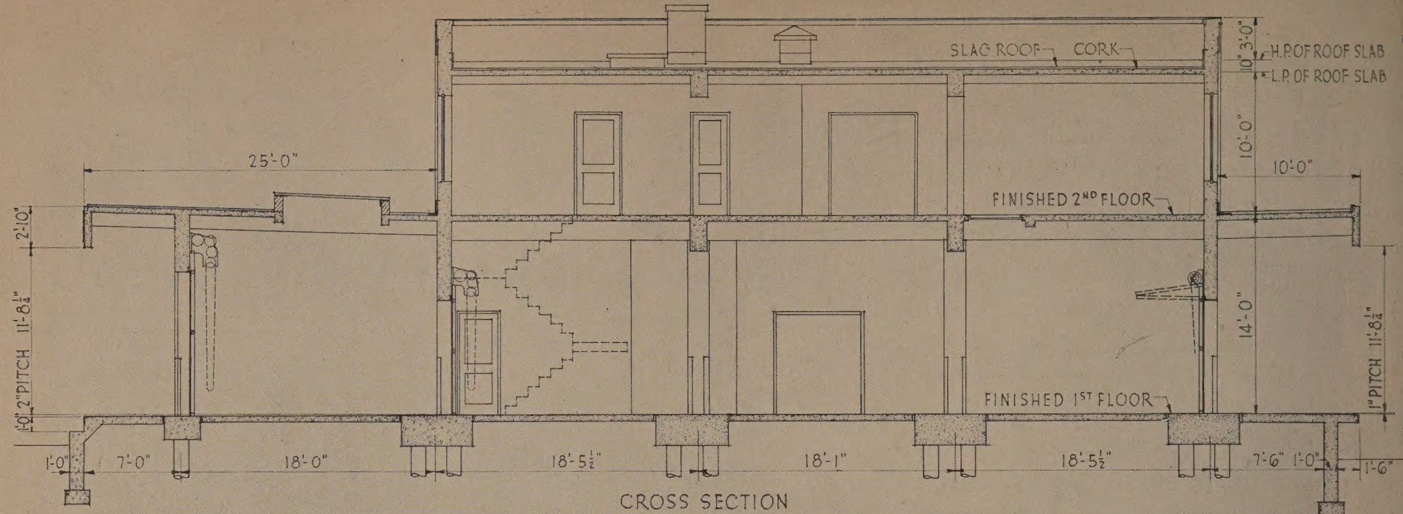
Plywood-lined wood forms were used throughout for forming the superstructure. Wood molds were used to construct the arched motif on the parapet walls.

Construction was carried on throughout winter months. Definite protection for the concrete, as it was placed, was afforded through the use of tar-

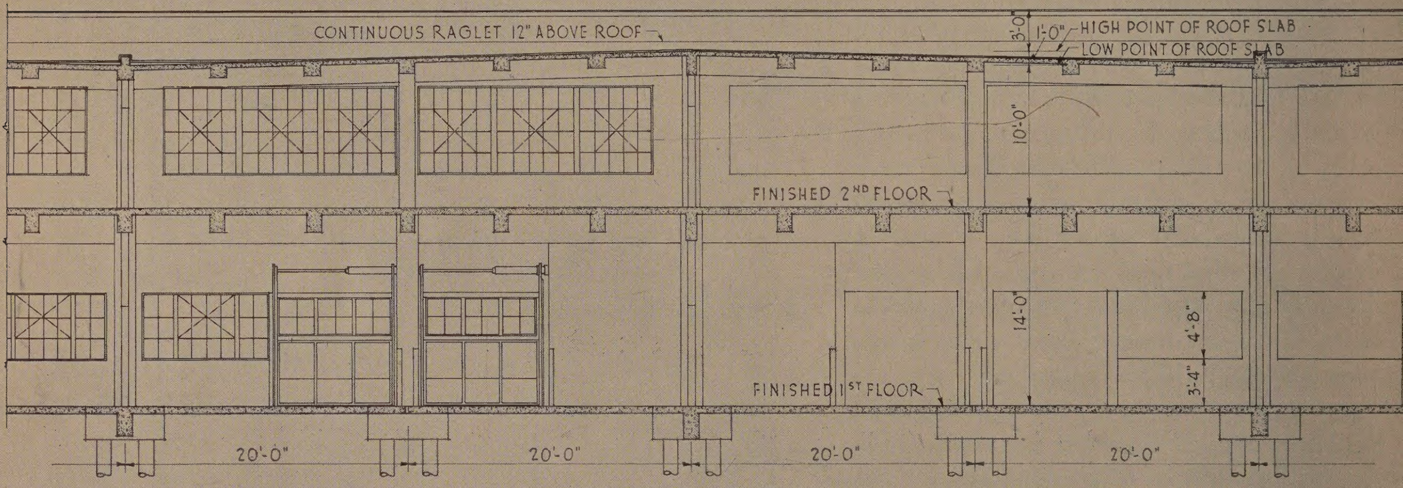


FLOOR AND ROOF EXPANSION JOINT DETAILS





CROSS SECTION



LONGITUDINAL SECTION

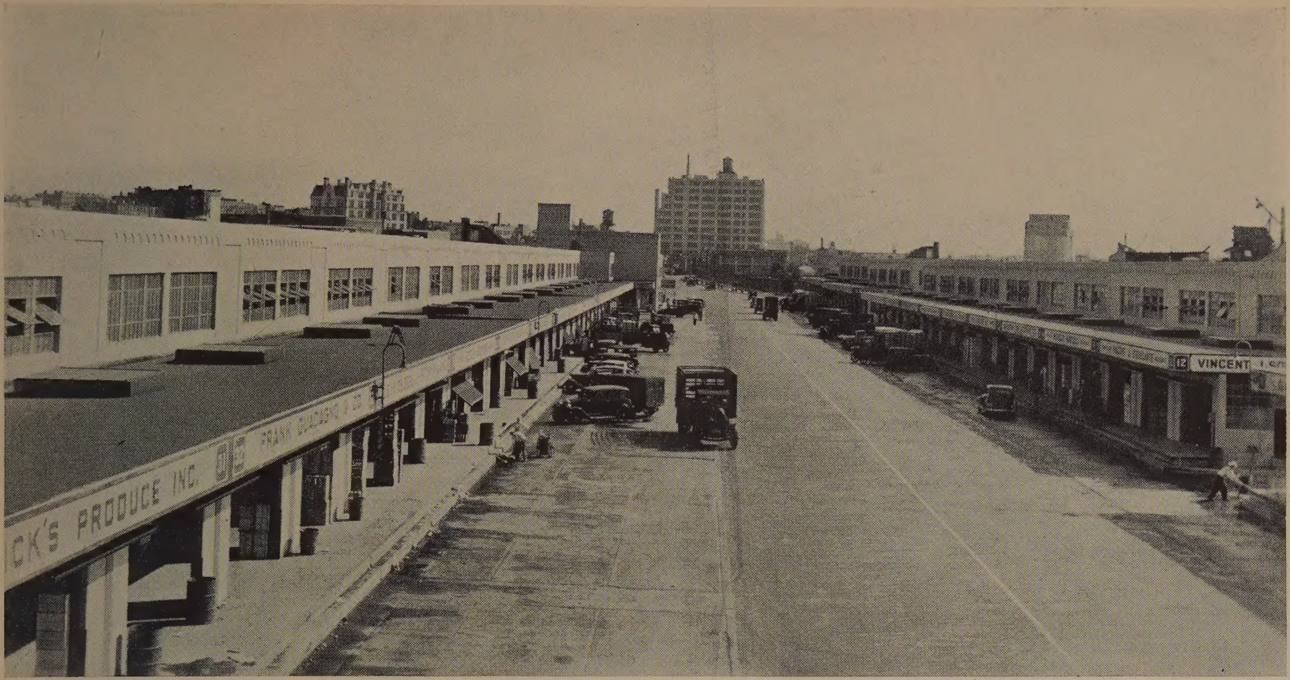
paulins which enclosed the portion under construction, heat being applied by salamanders properly located for the purpose. In order to expedite the making of concrete, the contractor set up a central mixing plant on the Harlem River dock immediately adjacent to the market site. Delivery of all materials was by barge.

Concrete was conveyed to various parts of the project in revolving drum trucks and then dumped into receiving hoppers at the base of several construction towers. It was elevated to the proper level and distributed to the forms in buggies. During cold weather, all aggregates and water were heated.

Concrete for the superstructure was designed for a compressive strength of not less than 2,000 p.s.i. at 28 days. The materials were proportioned to give a thoroughly plastic and workable mix while adhering rigidly to the water-cement ratio of not to exceed 6 gal. water per sack of cement, in order to insure durability even though the concrete developed much higher strength than required. An unvarying density of concrete was the constant aim of the contractors, who assigned a sufficient number of men to the job of puddling or otherwise working the concrete in the forms in order to produce surfaces free from honeycomb or other blemishes. Surfaces were cured by thoroughly wetting them several times daily over a period of several days. Application of two coats of light-yellow portland cement paint comprises the finish surface treatment.

Expansion joints, completely separating one portion of the structure from that adjoining, were located at intervals varying from 160 to 240 ft. Double columns and beams were used at the joints, allowing for 1-in. expansion, except between stores 6 and 7, 17 and 18, and 35 and 36, where 1½-in. expansion was provided. The joints not exposed to the weather were filled with Carey Elastite; those on the exterior were filled with Flexcell. Other details are in accordance with sketches shown on pages 37 and 39.

The original six-story Bronx Terminal Market, built under the administration of Mayor John F. Hylan, was



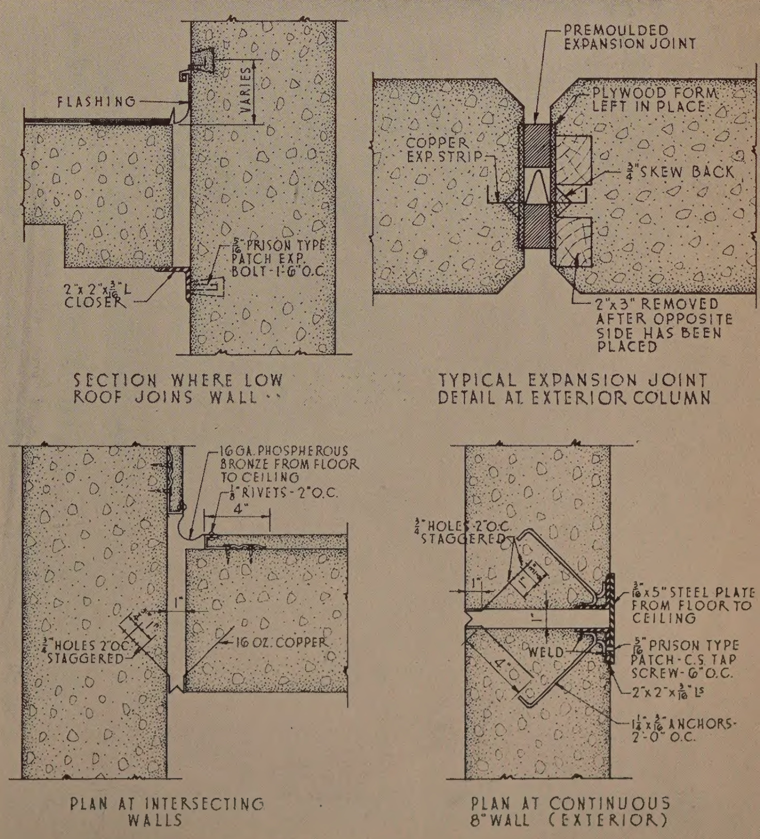
Merchants' buildings line both sides of Exterior Street. Each store has a truck platform on its street side and a railway loading platform at the rear.

known as "Hylan's Folly," because its cost and maintenance have thus far amounted to more than $18,000,000. The new market group, immediately adjacent to the older building, is said to be the most up-to-date market of its kind in the country. It has railroad sidings along the rear of the store buildings and loading platforms for trucks on the other side. Loading will be handled by the merchants themselves, directly to or from either freight or refrigerator cars. Direct access is also afforded to a number of piers and slips on the Harlem River, which runs beside the market site. The group of buildings is directly connected with the modern refrigeration plant and power house maintained by the city at the foot of 152nd Street.

One of the features of the new project is Farmers' Square, which lies between River and Cromwell Avenues at 150th Street. Space for 300 farm trucks is provided there. Three lofts in the store buildings have been equipped as lodgings, available to farmers at very moderate cost.

The first group of 47 stores was quickly leased for five-year terms long before completion. Stores in the second group are at this time also fully leased. Furthermore, the demand for store space has been so insistent that additional units are now being projected for early construction.

The structures comprising Bronx Terminal Market were erected under the general supervision of the architects through their resident superintendent, Lawrence K. Morrissey. D. M. Bartlett was active superintendent for the Turner Construction Co. during the entire construction period. Cooperating closely with architects and contractors during progress of the work were Carl W. Kimball, first deputy commissioner, and William R. Barry, resident superintendent, representing the Department of Public Markets, Weights and Measures of the City of New York.


FLASHING
VARIES
$\frac{5}{16}$" PRISON TYPE PATCH EXP. BOLT-1'-6" O.C.
2"x2"x$\frac{3}{16}$"L CLOSER
PREMOULDED EXPANSION JOINT
PLYWOOD FORM LEFT IN PLACE
COPPER EXP. STRIP
$\frac{3}{4}$" SKEW BACK
2"x3" REMOVED AFTER OPPOSITE SIDE HAS BEEN PLACED
16 GA. PHOSPHEROUS BRONZE FROM FLOOR TO CEILING
$\frac{1}{8}$" RIVETS-2" O.C.
4"
1"
$\frac{3}{4}$" HOLES 2" O.C. STAGGERED
16 OZ. COPPER
$\frac{3}{4}$" HOLES 2" O.C. STAGGERED
1"
$\frac{3}{16}$"x5" STEEL PLATE FROM FLOOR TO CEILING
WELD
4"
$\frac{5}{16}$" PRISON TYPE PATCH-C.S TAP SCREW-6" O.C.
2"x2"x$\frac{3}{16}$" Ls
$1\frac{1}{4}$"x$\frac{3}{16}$" ANCHORS-2'-0" O.C.

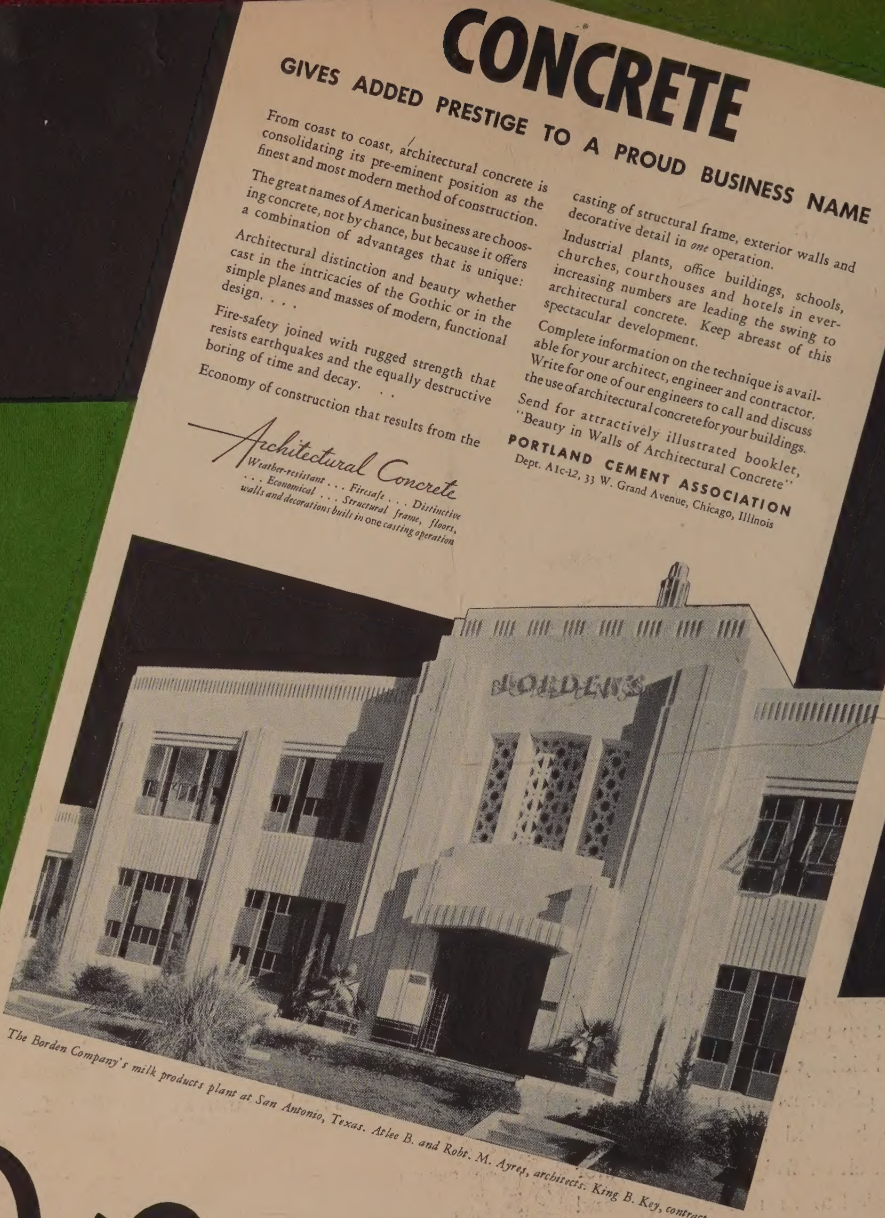
SECTION WHERE LOW ROOF JOINS WALL

TYPICAL EXPANSION JOINT DETAIL AT EXTERIOR COLUMN

PLAN AT INTERSECTING WALLS

PLAN AT CONTINUOUS 8" WALL (EXTERIOR)

WALL EXPANSION JOINT DETAILS



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